THE ARCHAEOLOGY OF
MEDITERRANEAN LANDSCAPES 1

Reconstructing Past Population Trends in Mediterranean Europe

Edited by John Bintliff
and Kostas Sbonias




The Archaeology of Mediterranean Landscapes

Series Editors
Graeme Barker and David Mattingly

1. Reconstructing Past Population Trends in Mediterranean Europe (3000 BC – AD 1800)
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General Editors' Introduction: The POPULUS Project

Graeme Barker and David Mattingly

This is one of five volumes being published by the POPULUS project, a European research network funded by the EU Human Capital and Mobility programme (Contract ERB CHRXCT930305) to address a series of methodological issues in Mediterranean landscape archaeology.

THE RESEARCH CONTEXT

Without a long historical perspective, research on changing demographic patterns in modern day Europe can only assess the impact of recurrent or perennial environmental and socio-economic aspects by constructing hypothetical models. The more empirically-based such models are, the greater their relevance to contemporary situations. This is particularly true of the less industrialized regions of Mediterranean Europe, where farming remains the principal economic focus and where the last decades have witnessed considerable migration of population to the cities or other more favoured economic regions. The problems facing these areas of the EU have an historic as well as a contemporary dimension and there is obvious importance in seeking to gain a clearer understanding of their long-term demographic trends.

Long-term demographic changes can be studied from many different perspectives and using many techniques, including history and the natural and social sciences. Numerous factors can be advanced to explain population growth and contraction (economic, environmental, social), but all research is hampered by the absence of detailed census records for much of the pre-modern period. However, landscape archaeology – a constellation of approaches and methodologies bridging the natural and social sciences, applied to both rural and urban contexts – has the potential to provide a major source of new information on the *longue durée* of human settlement in Mediterranean Europe. In recent years advances in field survey and excavation techniques, air photography, remote sensing, GIS (Geographical Information Systems), ceramic provenancing and dating have led to the accumulation of a wealth of new evidence on past settlement patterns. Potentially, therefore, the techniques of landscape archaeology offer the best opportunity significantly to advance our knowledge of European human demography in pre-industrial times, *c.* 3000 BC–AD 1800.

Despite this potential contribution of landscape archaeology, however, development has been uneven across Europe. In Mediterranean countries in particular, the traditional dominance of art historical approaches in archaeology, compounded by the strength of academic boundaries in other disciplines, has mitigated against the development of an approach to landscape analysis and demographic modelling that by definition demands an inter-disciplinary framework linking the natural and social sciences. Fieldwork in landscape archaeology has been the exception, not the rule. Moreover, where pioneering research has taken place, each team has tended to develop and use its own special methods (often reflecting a particular national tradition of archaeological research), with too little attention being paid to the necessity of achieving greater standardization of data sets. There are also specific problems relating to the interpretation of the status, size and length of occupation of the many sites that have been discovered. Scientific techniques can assist in refining the data so that more reliable demographic assessments can be made, but many interesting and important projects have not been able to make use of the full range of scientific techniques because the appropriate expertise is not available at the regional level. If landscape archaeology is to realize its potential to contribute significantly to debates on long-term demographic trends in Mediterranean Europe, it has to overcome the present lack of agreement on approaches and methods that makes meaningful comparisons between regional data difficult or impossible.

THE POPULUS OBJECTIVES

The aim of the POPULUS project, therefore, was to

investigate the feasibility of establishing a common series of research goals and standards in Mediterranean landscape archaeology so as to advance the study of the ancient demography of the region on a broad comparative front. A research network was established at five EU universities, each hosting a Working Party and training a trans-national Research Fellow in a specific sub-discipline within Landscape Archaeology, as follows:

- Prof Graeme Barker (School of Archaeological Studies, University of Leicester, UK) coordinated the overall project, and his colleague Dr David Mattingly co-ordinated the work of Working Party 1, and the training of the Research Fellow, in **Geographical Information Systems**;
- Dr John Bintliff (Department of Archaeology, University of Durham, UK) coordinated the work of Working Party 2, and the training of the Research Fellow, in **Demographic Modelling**;
- Prof Philippe Leveau (Centre Camille Julian, Université de Provence, France) coordinated the work of Working Party 3, and the training of the Research Fellow, in **Geoarchaeology**;
- Prof Riccardo Francovich (Dipartimento di Archeologia e Storia delle Arti, Università degli Studi di Siena, Italy) coordinated the work of Working Party 4, and the training of the Research Fellow, in **Field-survey Methodologies**, with particular emphasis on ceramic recording, provenancing and dating;
- Prof Marinella Pasquinucci (Dipartimento di Scienze Storiche del Mondo Antico, Università degli Studi di Pisa, Italy) coordinated the work of Working Party 5, and the training of the Research Fellow, in **Remote Sensing**, with particular emphasis on non-invasive techniques of archaeological survey.

The Working Parties were to bring together relevant expertise to define key issues in the methodologies of their research area, with a particular emphasis on the comparison of different research traditions and methods in different European countries. Each Working Party was to organise a Colloquium that would review methodologies and demonstrate best practice. The Research Fellows were to assist in the organisation of the Colloquia, and also to undertake research within their area of expertise and present their results to the relevant Colloquium. In addition, the Research Fellows and other members of the network were to collaborate in a programme of joint fieldwork to demonstrate the practical integration of improved and standardised methodologies in landscape archaeology. The principal outcome of POPULUS was to be the publication of the five colloquia, including the results of the joint fieldwork, together with a technical manual identifying best practice.

THE WORK PROGRAMME

The project started in January 1994 with the first meeting of the Steering Committee, composed of the coordinators in each of the partner universities. The Research Fellows were appointed through 1994: Leicester in January, Durham in April, Aix-en-Provence in April, Siena from February, and Pisa from June. The Working Parties met through 1994 and 1995, and the Research Fellows' training and field research were also undertaken during 1994 and 1995. In 1995 the project was expanded and strengthened with the addition of a team from the Department of Archaeology at the University of Ljubljana in Slovenia coordinated by Dr Predrag Novaković, under a supplementary EU grant (Contract ERBCIPD940624). The Colloquia took place in the autumn of 1995 and spring of 1996, the papers being revised by their authors through 1996, and then being edited at the five universities by the local coordinators and finally at Leicester (including several that were also translated into English after the main editing) by the General Editors during 1997.

THE WORKING PARTIES

The Working Parties were deliberately set up in terms of personnel from the network and from other universities and institutions to reflect the diversity of Community traditions and methodologies in each of the five main areas addressed. Working Party 1 had members from Britain, France, Greece, Holland, Italy, and Slovenia. Working Party 2 had members from Britain, France, Germany, Greece, Holland, Italy, and Slovenia. Working Party 3 had members from Britain, France, Italy, Spain and Slovenia. Working Party 4 had members from Britain, France, Holland, Italy, Spain and Slovenia. Working Party 5 had members from Britain, France, Greece, Italy and Slovenia.

THE RESEARCH FELLOWS

Under the terms of the Human Capital and Mobility programme, the Research Fellows were to be appointed from EU countries other than the designated place of work. This requirement of the Human Capital and Mobility programme was also seen as an extremely positive contribution to the goals of POPULUS, because the mobility of young archaeologists from one Community country to another was an important part of the process of integrating the different European intellectual and methodological traditions in landscape archaeology. The partner institutions proposed individuals where suitable qualified personnel were available, and the posts were also advertized widely through EU universities, museums and state archaeological services. The Leicester Research Fellow in GIS was Dr Jan van Dalen, a Dutch national with a first and second degree at Leiden University, who was

working for the Dutch Archaeological Service on a programme developing GIS for predictive modelling of site distributions to aid their strategies of heritage management. The Durham Research Fellow in Demographic Modelling was Dr Kostas Sbonias, a Greek national with a first degree at Athens University in archaeology, a PhD from Heidelberg University, and extensive postgraduate experience in Greek landscape archaeology projects. The Aix-en-Provence Research Fellow in Geoarchaeology was Dr Kevin Walsh, a British national with a first degree in archaeology and geography at Lampeter University and an MA and a PhD in environmental archaeology at Leicester University. The Siena Research Fellow in Field Survey Methodologies was a British national, Dr Helen Patterson, who had a first degree in archaeology at Reading University and a PhD in ceramic analysis at Sheffield University, the latter with a primary focus on the analysis of medieval ceramics from a field survey and excavation project in Italy. The Pisa Research Fellow in Remote Sensing was a French national, Dr Frédéric Trément, who had a first degree in archaeology at the University of Lille and a PhD at the University of Aix-en-Provence in landscape archaeology. The Ljubljana Research Fellow was a Greek national, Mrs Helene Simoni, with a first degree in classical archaeology at the University of Athens and an MA in Landscape Studies at the University of Leicester. Her MA had included training in GIS, and she was appointed to Ljubljana to receive further training, and then to undertake research, in GIS.

The Research Fellows prepared discussion documents for each meeting of their respective Working Party. For the first meetings they gathered information about current archaeological research in the Mediterranean relevant to the activities of their Working Party, to help define the key issues for the subsequent Working Party meetings and the themes of the Colloquia, and to suggest names of appropriate speakers. In subsequent meetings they reported further developments in this data-gathering exercise, and also reported on their own field research. Supported by their supervisor (the regional coordinator), they were charged with the primary responsibility for the organization of their respective Colloquia including the soliciting of papers, the circulation of pre-prints to discussants, the running of the Colloquia, and liaison with speakers afterwards to secure finalized versions of papers. They also undertook as much of the preliminary editing of the proceedings as possible before the cessation of their contracts. Dr Trément in particular undertook much of the editing of the Aix as well as the Pisa Colloquia after the Aix Research Fellow left the project before the end of his contract for another post, Dr Trément transfering from Pisa to Leicester from February to June 1995 for this purpose. Each Research Fellow contributed an introductory paper to their Colloqium identifying the major strengths and weakness of current methodologies in their area of specialism, and has provided the supplementary information for the Manual of Best Practice. They also undertook field research that is published as separate Colloquia contributions and/or in publications on specific projects.

THE POPULUS COLLOQUIA

The five Colloquia took place on 13–16 October (Aix), 6–8 November (Leicester), 25–26 November (Durham), 1–3 December (Siena) and 4–6 December (Pisa) in 1995. Each Working Party coordinator was successful in obtaining limited additional funds locally (university, local administration etc) or nationally to augment the POPULUS budget for the travel and accommodation costs of speakers, and the Project Coordinator also secured a grant of £500 from the British Academy towards the travel costs of a speaker from the US attending the Leicester and Durham Colloquia. The Colloquia were structured to enhance debate amongst the different EU traditions of landscape archaeology. All papers were pre-circulated, and the main focus for each paper at most of the Colloquia was a presentation not by the authors of the paper but by a discussant from another country, followed by a brief response by the author(s) and then an open debate amongst the Colloquium participants. All five colloquia were characterized by vigorous but positive and friendly debate, and the papers were re-written by their authors in the light of the discussions and the general themes and issues that emerged.

THE POPULUS VOLUMES

The five Colloquia are being published as a series by Oxbow Books under the title *Mediterranean Landscapes,* with Graeme Barker and David Mattingly as Series Editors. The five volumes are: *1. Reconstructing Past Population Trends in Mediterranean Europe (3000 BC – AD 1800)* edited by John Bintliff and Kostas Sbonias; 2. *Environmental Reconstruction in Mediterranean Landscape Archaeology* edited by Philippe Leveau, Frédéric Trément, Kevin Walsh and Graeme Barker; *3. Geographical Information Systems and Landscape Archaeology* edited by Mark Gillings, David Mattingly and Jan van Dalen; *4. Non-Destructive Techniques Applied to Landscape Archaeology* edited by Marinella Pasquinucci and Frédéric Trément; and *5. Extracting Meaning from Ploughsoil Assemblages* edited by Riccardo Francovich and Helen Patterson. The POPULUS volumes bring together a remarkable array of EU expertise in current approaches to Mediterranean landscape archaeology: the papers present the researches of 30 British, 4 German, 6 Dutch, 27 French, 4 Greek, 35 Italian, 8 Slovenian, and 6 Spanish scholars, as well as those of 11 Canadian/US scholars working in the region. They bridge the disciplinary and national boundaries that have mitigated against the development of a coherent methodology in Mediterranean landscape archaeology. The contents are as follows:

1. Reconstructing Past Population Trends in Mediterranean Europe (3000 BC – AD 1800)

edited by John Bintliff and Kostas Sbonias

ARCHAEOLOGICAL SURVEY AND DEMOGRAPHY:
1. *Introduction to issues in demography and survey.* Kostas Sbonias.
2. *Regional field surveys and population cycles.* John Bintliff.
3. *Counting people in an artefact-poor landscape: the Langadas case, Macedonia, Greece.* Stelios Andreou and Kostas Kotsakis.
4. *Demographic trends from archaeological survey: case studies from the Levant and Near East.* Tony Wilkinson.
5. *Archaeological proxy-data for demographic reconstructions: facts, factoids or fiction?* John Chapman.
6. *An attempt at the demographic interpretation of long-term settlement processes in the prehistory of Slovenia: the case of the 'archaeological map of Slovenia'.* Predrag Novaković.
7. *Prospection archéologique et démographie en Provence: approche paléodémographique de la Rive Occidentale de l'Etang de Berre sur la longue durée.* Frédéric Trément.
8. *Demography and Romanization in central Italy.* Franco Cambi.
9. *Beyond historical demography: the contribution of archaeological survey.* Simon Stoddart.

INTERDISCIPLINARY APPROACHES:
10. *Chance and the human population: population growth in the Mediterranean.* Ezra Zubrow and Jennifer Robinson.
11. *The potential of historical demography for regional studies.* Malcolm Smith.
12. *Clearing away the cobwebs: a critical perspective on historical sources for Roman population history.* Tim Parkin.
13. *The population of Roman Italy in town and country.* Elio Lo Cascio.
14. *Documentary sources for the history of medieval settlements in Tuscany.* Maria Ginatempo and Andrea Giorgi.
15. *The Ottoman Imperial Registers: central Greece and northern Bulgaria in the 15th–19th centuries – the demographic development of two areas compared.* Machiel Kiel.
16. *Investigating the interface between regional survey, historical demography and palaeodemography.* Kostas Sbonias.
17. *The contribution of palaeoanthropology to regional demographic history.* C. A. Marlow.
18. *Problems and prospects in palaeodemography.* Claude Masset.
19. *Relating cemetery studies to regional survey: Rocca San Silvestro, a case study.* Riccardo Francovich and Kathy Gruspier.
20. *Counting heads: an overview.* Jeremy Paterson.

2. Environmental Reconstruction in Mediterranean Landscape Archaeology

edited by Philippe Leveau, Frédéric Trément, Kevin Walsh and Graeme Barker

1. *Mediterranean landscape archaeology and environmental reconstruction.* K. Walsh
2. *Landscape archaeology and reconstruction of the Mediterranean environment based on palynology.* S. Bottema
3. *A computerized database for the palynological recording of human activity in the Mediterranean basin.* V. Andrieu, E. Brugiapaglia, R. Cheddadi, M. Reille and J.-L. de Beaulieu
4. *Reconstructing vegetation and landscapes in the Mediterranean: the contribution of anthracology.* J.-L. Vernet
5. *Some examples of climatic reconstruction in the Mediterranean using dendroclimatology.* F. Guibal
6. *Geomorphological techniques in Mediterranean landscape archaeology.* A. G. Brown
7. *L'apport de la micromorphologie des sols à la reconstitution des paléopaysages (Application au bassin méditerranéen pour la période 3000 av. J. C. – 1800 ap. J. C.).* N. Fédoroff et Marie-Agnès Courty
8. *Reconstructing past soil environments in the Mediterranean region.* R. S. Shiel
9. *Energy dispersive X-ray micro-analysis and the geochemistry of soil sediments.* D. D. Gilbertson and J. P. Grattan
10. *Searching for the ports of Troy.* E. Zangger, M. Timpson, S. Yazvenko and H. Leiermann
11. *Case studies from the Pontine region in central Italy on settlement and environmental change in the first millennium BC.* P. Attema, J. Delvigne and B. J. Haagsma
12. *Karst dolinas: evidence of population pressure and exploitation of agricultural resources in karstic landscapes.* P. Novaković, H. Simoni and B. Mušič
13. *Archeologia ambientale padana: un caso di studio – la pianura padana centrale tra il Bronzo medio ed il Bronzo finale (xvi–xiii sec. a. C.).* M. Cremaschi.
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15. *Developing a methodological approach to the evolution of field systems in the middle Rhône valley.* J.-F. Berger and C. Jung

3. Geographical Information Systems and Landscape Archaeology

edited by Mark Gillings, David Mattingly and Jan van Dalen

4. Non-Destructive Techniques Applied to Landscape Archaeology

edited by Marinella Pasquinucci and Frédéric Trément

5. Extracting Meaning from Ploughsoil Assemblages

edited by Riccardo Francovich and Helen Patterson

18. *Terracotta and its territory: a tormented relationship.* Franco Cambi.
19. *The Adriatic Islands Project: contact, commerce and commercialization.* Vincent Gaffney, Branco Kirigin, John W. Hayes, and Peter Leach.
20. *De la fouille à la prospection, et retour: céramologie et histoire du peuplement dans la cité de Nimes.* Claude Raynaud.
21. *Il rapporto fra superficie e sottosuolo; dal survey allo scavo: insediamento e circolazione ceramica fra V e X secolo nella Toscana centro-meridionale.* Riccardo Francovich and Marco Valenti.
22. *Reconstructing the classical landscape with figures: some interpretive explorations in North-West Keos.* Todd Whitelaw.
23. *Demographic trends: the contribution of regional survey data.* John Bintliff and Kostas Sbonias.
24. *Conclusion.* Susan E. Alcock, Franco Cambi, Simon Keay, and Claude Raynaud.

SCIENTIFIC OUTCOMES

All five working groups in the POPULUS network were able to agree on areas of best practice, whilst eschewing the idea of a 'cookbook' approach to methodologies in landscape archaeology, the results of which have been incorporated into the Manual of Best Practice that is currently in the final stages of completion. Its future use by Community archaeologists working in Mediterranean landscape archaeology will be the ultimate test of the effectiveness of the POPULUS project in integrating the best of the diversity of current methodologies in the discipline.

During the discussions of the Working Parties, several alternative views were expressed about the way regional archaeological research and landscape archaeology should be conducted. At one end of the spectrum were some archaeologists who advocated that they (the archaeologists) should enlist a battery of natural scientists and tap into their results for the purpose of understanding the environmental context of an excavation or survey record. At the other end of the spectrum were some geographers who proposed that they (the scientists) should run the regional archaeological projects, the head scientist being partnered by an archaeologist. As Graeme Barker and John Bintliff comment at the end of the Aix-en-Provence volume *Mediterranean Landscape Archaeology* 2, the conclusion from the Colloquia is that both these positions lack one fundamental component: where do we find the interpretative approaches for the human-landscape interaction that constitutes the prime reason that these many specialists are working alongside each other? The work of the POPULUS network has emphasized the enormous potential of effective partnerships between broad-based teams of geoarchaeologists and modern intensive survey teams. Reconstructing the history of Mediterranean landscape change and demography certainly needs natural scientists to analyze the changing forms of the landscape, and archaeologists to analyze changing settlement morphologies and systems. To *understand* that history, however, in terms of the interactions between landscape and people, and the perceptions, choices and adaptations that have underpinned human actions, will need effective partnerships between broad-based teams of archaeologists, geoarchaeologists, historians, and anthropologists. The greatest challenge of inter-disciplinary landscape archaeology in the Mediterranean in the coming years will be how to bridge the divide between the ecological approaches of the natural sciences to past landscapes, on the one hand, and the concerns of social archaeologists on the other with the interface between human actions and landscape.

In terms of modelling major trends in Mediterranean landscape history, one consistent theme for teams working in the eastern and western Mediterranean emerging from the POPULUS network is evidence for settlement shifts, population increase and agricultural intensification in the third millennium BC, and the extent to which these changes coincide with and are related to marked increases in the scale of human impact on sediments and vegetation and/or with climatic change. Regional inter-disciplinary landscape projects are also contributing as profoundly to our understanding of the impact of Roman imperial expansion and subsequent Romanization on the human and natural landscapes of the Mediterranean. Another central concern is the relative impact of climatic fluctuations and human impact in terms of dramatic environmental change: here, one significant weakness of current work is the lack of emphasis on investigating the prehistory and history of Mediterranean uplands. Some of the major landscape changes we can now detect in the Mediterranean region were the result of gradual long-term processes, others may have been caused by catastrophic events of short duration and very long recurrence intervals. The widespread application of dating techniques such as luminescence and palaeomagnetism in the coming years is likely to have an enormous impact in this respect: more refined chronologies seem likely to emphasize different rates of landscape change rather than uniformity, with profound implications for our understanding of human interactions with their landscape.

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Addresses of Contributors

Stelios Andreou, Aristotle University of Thessaloniki, Department of Archaeology and History of Art, 54006 Thessaloniki, Greece.

John Bintliff, Department of Archaeology, University of Durham, South Rd., Durham DH1 3LE, UK.

Franco Cambi, Universita degli Studi di Siena, Dipartimento di Archeologia e Storia delle Arti, Via Roma 56, 53100 Siena, Italy.

John Chapman, Department of Archaeology, University of Durham, South Rd., Durham DH1 3LE, UK.

Riccardo Francovich, Universita degli Studi di Siena, Dipartimento di Archeologia e Storia delle Arti, Via Roma 56, 53100 Siena, Italy.

Maria Ginatempo, Universita degli Studi di Siena, Dipartimento di Storia, Via Roma 56, 53100 Siena, Italy.

Andrea Giorgi, Universita degli Studi di Siena, Dipartimento di Storia, Via Roma 56, 53100 Siena, Italy.

Kathy Gruspier, RR #1, Schomberg, Ontario, LOG 1T0, Canada.

Jennifer M. Robinson, National Center for Geographic Information Analysis, School of Biological and Environmental Sciences, Murdoch University, Perth, Western Australia.

Machiel Kiel, Joseph Rothstrasse 94, 53175 Bonn, Germany.

Kostas Kotsakis, Aristotle University of Thessaloniki, Department of Archaeology and History of Art, 54006 Thessaloniki, Greece.

Elio Lo Cascio, Via Ugo de Carolis 136, 00136 Roma, Italy.

C.A. Marlow, Department of Anthropology, University of Durham, 43 Old Elvet, Durham DH1 3HN and University College Stockton, University Boulevard, Thorneby Stockton on Tees, Cleveland, UK.

Claude Masset, 39, Rue Blomet, 75015 Paris, France.

Predrag Novaković, Department of Archaeology, University of Ljubljana, P.O.B. 580, 61001 Ljubljana, Slovenia.

Tim Parkin, Victoria University of Wellington, Department of Classics, P.O. Box 600, Wellington, New Zealand.

Jeremy Paterson, Department of Classics, University of Newcastle, Newcastle upon Tyne NE 1 7RU, UK.

Kostas Sbonias, 35 Vernardaki str., Athens 115 22, Greece.

Malcolm Smith, Department of Anthropology, University of Durham, 43 Old Elvet, Durham DH1 3HN, UK.

Simon Stoddart, Department of Archaeology, University of Cambridge, Downing St., Cambridge CB2 3OZ

Frédéric Trément, Dépt d'Histoire, Université Blaise – Pascal, Clermont – Ferrand II, 63037 Clermont-Ferrand, France

Tony J. Wilkinson, The Oriental Institute, The University of Chicago, 1155 East 58th Street, Chicago 60637, Illinois USA.

Ezra B.W. Zubrow, National Center for Geographic Information Analysis, Department of Anthropology, The State University of New York at Buffalo, Buffalo, New York 14261, USA.

1. Introduction to Issues in Demography and Survey

Kostas Sbonias

INTRODUCTION

Demography is the formal study of the characteristics of human populations: size, structure, fertility, mortality, migration, and development. The emphasis of formal demography is on the description of a given population and on the study of the internal relations between the structure of the population and the changes within the population (Welinder, 1979: 29). Apart from the internal mathematical demographic theory there is a body of theory mainly in other disciplines like economics, sociology, anthropology, and history about the role of population as a factor in cultural change and/or the initial conditions affecting population processes. Demographic research can be widened to include bio-social and socio-economic aspects of the relation between the structure and dynamics of the population and its environment in a broad sense (Ammerman, 1989: 70; Welinder, 1979; Schofield and Coleman, 1986).

In respect of past populations demographic archaeology uses a wide range of methods to study topics such as birth and death rates, distribution of population among sex and age groups, health, diseases, nutrition, life tables (the mortality pattern of a population), estimation of the size of population at a defined point of time as well as changes in the size and structure of population aggregates through the study of settlement patterns and cemetery data (Hassan, 1979, 1981; Schacht, 1981; Petersen, 1975; Colb, 1985).

The emphasis of the Populus Project, on which the Durham Conference is based, is on landscape archaeology and the way survey data can be used to address issues about the development of demography in Mediterranean Europe. Intensive Survey is an archaeological technique that consists of total fieldwalking across the countryside in continuous blocks or in samples producing quantitative estimates of the distribution of ceramic on the surface (Figure 1.1).

Evaluation of this surface pottery permits us to generate settlement distributions (Figure 1.2), or estimate the size of sites and locate zones of agricultural intensification, data which open up new possibilities in the study of social, economic and demographic trends (for collective volumes that present a variety of case studies from regional archaeological surveys see Barker and Hodges [eds] 1981; Keller and Rupp [eds] 1983; Macready and Thompson [eds] 1985; Haselgrove, Millett and Smith [eds] 1985; Schofield [ed.] 1991; Barker and Lloyd [eds] 1991; Herring, Whitehouse and Wilkins [eds] 1992; Alcock, 1993). Demographic subjects which can be studied through settlement patterns are:

i) estimation of the population size of a region at a given period of time with emphasis on the discussion of methodological questions about the reliability of the data,

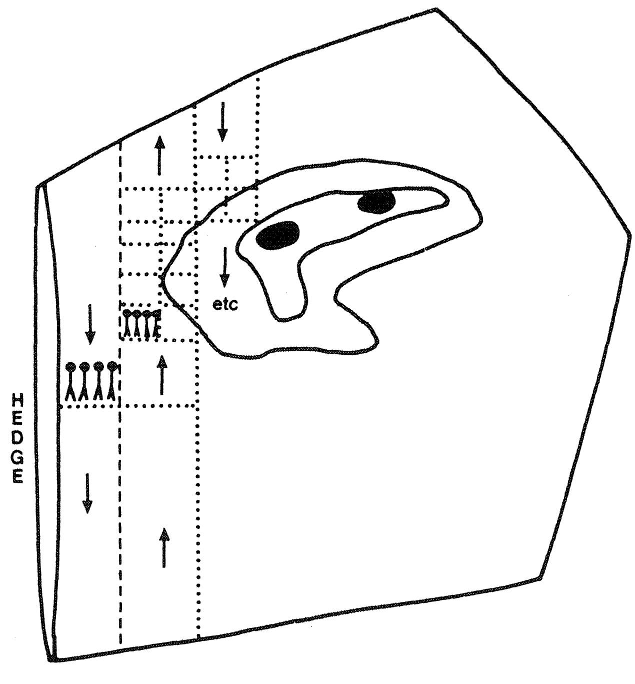

Figure 1.1. Survey methodology: intensive coverage of the surface by fieldwalkers placed a few metres apart (from Bintliff, 1992: 99 fig. 11).

ii) detection of changes in the demographic patterns in the medium and long term,
iii) differences in the population trends across space,
iv) through the analysis of the off-site data and reconstruction of past land use and intensity of cultivation, surveys contribute further to the estimation of the population size on the basis of carrying capacity.
v) explanation of population change.

From the point of view of a modern demographer these issues could be characterised as crude, and there is no doubt that in making settlement patterns the core study focus of the Populus Project the methodological scope is being narrowed, with important demographic aspects being excluded. On the other hand the quality and degree of detail offered by recent surveys create new possibilities for demographic archaeology. The difference in the data now available is striking if we compare them with works of historical demography some decades ago.

Norman Pounds for example (1969) trying to estimate the number of sites within a given area argued that the archaeological evidence is too incomplete to be more than supplementary to the written evidence, and that for Classical Greece it is epigraphical evidence which throws most light on the number and size of the city states. Using epigraphic evidence, especially the number of sites which joined the Athenian League and paid tribute proportionate to their means, but also literary evidence (i.e. poleis mentioned by Pausanias and Polybios as well sites mentioned by early travellers and known from the archaeological record), he came to a number of 750 poleis in peninsular Greece (Pounds, 1969: 137). Producing that way a settlement pattern he tried further to estimate the population of the Chalkidike region in Macedonia on the grounds of tribute paid from the 28 Chalkidikean poleis to the Athenian League, information known from epigraphic material. Apart from problems concerning Pounds' argument (cf. Nixon and Price, 1990 for criticisms regarding the lack of a simple correlation between tribute and population size underlying the tribute assessments) we should stress the difference in quality between such maps of sites as Pounds', which rely totally on historical evidence to produce a pattern of past settlements (which can't always be differentiated in periods, and besides ignore smaller rural sites), and detailed period by period maps of modern intensive surveys with hierarchies of settlements according to size and function.

INTERPRETING ARTIFACTUAL DISTRIBUTION

Distribution maps produced from intensive surveys offer therefore important material to start a discussion about demography. The simplest way used generally to make demographic inferences, is treating the number of known sites as relative population figures, and comparison of the settlement density between the different periods is often interpreted in terms of differences in the population size. We should keep in mind though that a gross demographic curve or a map of sites is an interpretation. What we get from a survey is a pattern of artifactual distribution and a number of issues should be considered before we treat these distributions as an actual pattern of past settlements. As the relation between number of sites and population figures is not a simple one, different models and factors should be evaluated for the interpretation of curves of number of sites against time. The following broad categories can be defined, of which only one is related to demography:

i) factors connected with survey methodology (biassed picture resulting from methods of observation, recording and collection in the field, different criteria for the definition of sites, intensity of survey)
ii) deposition of artifacts, relation of the surface collections to the various ages, differential preservation of sites
iii) dating, contemporaneity problem
iv) scale of the period and area studied (micro-/macro-level)
v) social and economic factors affecting the form of curves
vi) change in the population size

Definition of sites

Sites either as number, size or function is a basic concept on which a demographic reconstruction on the basis of survey data is based. But as the concept of a site is an interpretation of the ceramic distributions recorded on the surface, the criteria for the site definition as well as the methods used for the recording and calculation of the density of artifacts must be explicit. Intensive surveys putting weight in their original stages on quantification and objective criteria for the site definition tried to have some consistency as to what is the lowest on-site density for the recognition of sites (in projects in southern Greece being 30–50 sherds per 100 sq. metre, cf. Cherry *et al.*, 1991: 39–40). The use of pottery thresholds must allow for regional variability, as comparison of site and off-site densities in Western Europe, the Mediterranean and Near East has shown different levels of artefact densities, attributed by Bintliff and Snodgrass to different regional geomorphic processes (Bintliff and Snodgrass, 1988: 510 figure 2). Yet although a common understanding must exist on what are the crucial differences between areas and sites within the time-space matrix and on the broad set of criteria for the on- and off-site record (cf. Perkins, in press for an example of criteria used for the classification of roman sites), as survey studies mature the complex nature of the surface data becomes evident. Single quantified criteria are not adequate for the definition of sites, qualitative criteria have to be taken into account, the structure of the data considered and the differences in the rates of cultural

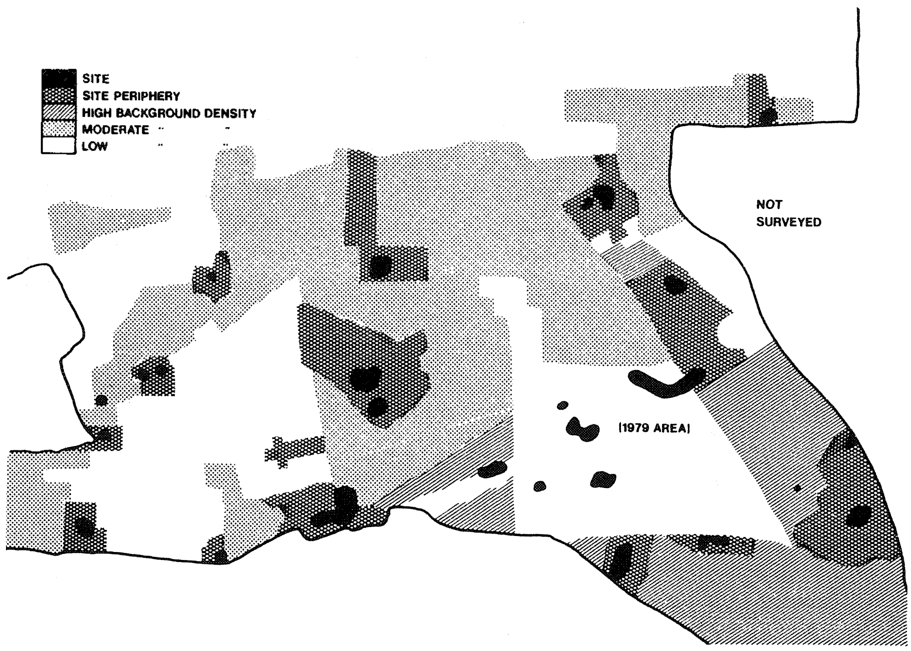

Figure 1.2. Surface ceramic distribution produced by intensive coverage of the surface in the Boeotia survey (from Bintliff, 1992: 95 fig. 6).

deposition and preservation of material from different periods and regions taken into consideration (cf. Andreou and Kotsakis, this volume for an artifact poor landscape; papers in Schofield, ed., 1991; Bintliff, in press; Coccia and Mattingly, 1992: 228–229).

Intensity of survey

Another factor which might cause a biassed picture is the intensity of the surveys. There is much discussion in the literature about different kind of surveys according to their search intensity and the reliability of their results. Considerable critique has been exercised on extensive surveys by which the coverage of a region is achieved not by field by field walking but by predictions of site location, having as a result biasses towards the major sites (Cherry, 1982: 15; Bintliff and Snodgrass, 1985). As often the number of recorded sites is used as a relative indication for demographic figures, it is evident that for the comparison of the results of different surveys the relationship between the intensity of the survey and number of sites found has to be taken into account .

In Greece for example it has been shown that recent intensive surveys concentrating on smaller study areas have produced site densities as much as 100 times greater than those reported by earlier large scale extensive projects (Bintliff & Snodgrass, 1988: fig. 14.3 and 1985: fig. 10–11; Cherry *et al.*, 1991: 18–19 fig. 2.3). A comparison in Figure 1.3 of the cumulative plot of site sizes between the extensive Messenia survey and the intensive Boeotia survey reveals the considerable difference, especially in regard to the lower end of the range

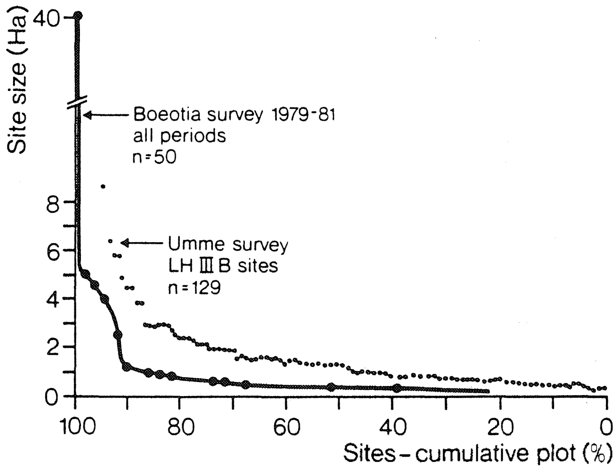

Figure 1.3. Comparison of the Messenia and Boeotia survey in respect of the site size ranges discovered by the survey (from Bintliff and Snodgrass, 1985: fig. 10).

of site-sizes. Figure 1.4 shows another example of the variability in the density of total sites per sq km recorded by Greek surveys, differences which to a great extent are related to the intensity of the survey and not directly to different population sizes. Developing a common survey methodology is therefore a matter of importance if we are to use different survey results for a demographic reconstruction. For surveys with different methodologies, calibrating recorded densities against type and intensity of survey is a way to evaluate and compare the results. Knowing for example that the Minnesota Messenia survey (Mc Donald & Rapp, 1972) focussed on the discovery of

the bigger sites can be useful in the interpretation of the distribution maps of that survey. And indeed John Chadwick (1976: 41), examining the list of place names in the Pylos tablets and trying to recreate the map of Mycenaean Messenia, remarked that the number of sites mentioned in the tablets and estimated at around two hundred coincides with the same figure of sites found in the archaeological survey of the area, something quite possible since, as already said, the Messenia survey failed to discover minor rural sites.

Evaluating missing sites

An important factor for the reliability of our demographic observations is evaluating the missing sites in a settlement pattern. It is generally accepted that surveys don't find all the surface sites in a region and revisiting the surveyed areas reveals a disappearance of known sites and appearance of new ones. Biasses might exist especially towards small, short lived, older or long-exposed sites. The number of sites recorded (especially that of the small ones) represents thus only a proportion of the original site number. A series of best practice measures might be taken, as for example recurrent survey of the same sites under different cultivation and climatic conditions (Barker and Symonds, 1984: 287–288; Terrenato and Ammerman, 1996: 92); detailed geomorphologic studies and reconstruction of the erosional history and soil formation processes of a region (Pope and Van Andel, 1984; Cherry *et al.*, 1988; Wells, Runnels & Zangger, 1990); high intensity site case-studies using additional methods such as geophysics, geochemistry and augering (cf. for example Bintliff *et al.*, 1990 and Rimmington, in press, for soil geochemistry in the Boeotia survey; Coccia and Mattingly, 1992: 248–253 for use of resistivity in the Rieti survey; Barker, 1995: 51–54 for geophysics and augering in the Molise survey). The message from the re-surveying experiments conducted in the Biferno and Montarrenti surveys is optimistic, where in spite of the appearance and disappearance of sites the settlement models constructed were found to remain essentially the same (Barker, 1995: 49–50, fig. 24). Ultimately though it is through adjustments to allow for missing sites that gaps can be evaluated. Visibility correction factors for example can be used to control surface vegetation (Bintliff and Snodgrass, 1985; Gaffney, Bintliff & Slapsak, 1991) or combined factors of ground cover and geomorphology (Terrenato and Ammerman, 1996). Further, an understanding of the different classes of sites present in a settlement pattern in respect to size, age and type is necessary, as well as a notion of their representativity in the landscape. Approaches to assess this relationship range from simulating the percentages of buried material coming to the surface (Terrenato and Ammerman, 1996: 93–95) to more traditional approaches of reconciliation with historical figures. Cambi (this volume) mentions for example that the Albegna survey might have found 20% of the potential sites.

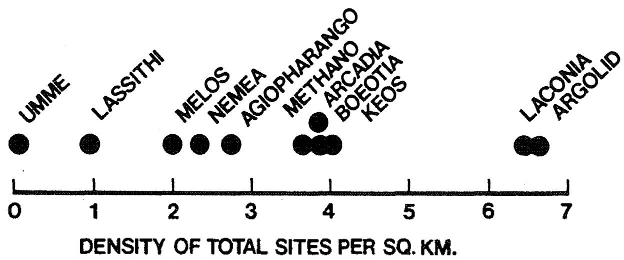

Figure 1.4. Comparison of the site density per sq. km recorded by several Greek surveys (from Bintliff 1992: 92 fig. 3).

Terrenato and Ammerman (1996: 106) conclude on the basis of their visibility analysis that only half of the sites have been discovered in the Cecina valley survey. Bintliff argues that for the Classical period 43% of the Boeotian sites are missing, the bias being mainly against the small rural sites. Yet as these might have sheltered only a small proportion of the population (around 20%) the overall bias in the estimation of the Boeotian population would not be critical (see discussion in Bintliff, 1985, 1988 and 1997a).

Prehistoric/historical pattern

In contrast to the Classical period, evaluating the missing sites for the prehistoric period is much more difficult. Prehistoric activity is represented by a few sites and a very small quantity of pottery and this may distort considerably the prehistoric settlement pattern, besides making the comparison between the prehistoric and historical periods problematic. Many factors might have distorted the pattern. Poorer survival of prehistoric pottery (Rutter, 1983), smaller size of prehistoric sites, less easily recognisable material along with environmental biasses such as alluvium, erosion, agricultural disturbance etc. (Di Gennaro and Stoddart, 1982; Burillo *et al.*, 1984) could be mentioned. Another reason might be the fact that earlier periods on a site are swamped by greater quantities of overlying material and therefore the greater the intensity of later occupation the smaller the chance of recovering prehistoric sites. In Figure 1.5, for example, based on the results of the Kea survey, John Cherry *et al.* (1991: 223 fig. 9.7) relating the number of prehistoric finds at a site to the number of later finds, examine the effect of later reoccupation on our perception of the intensity and extent of prehistoric activity. In the graph it can be clearly seen that those sites with the most prehistoric pottery recorded have the least evidence for reoccupation in later periods, in contrast to the sites with much historic material, which revealed only a small amount of prehistoric material.

One speculative approach to these problems is presented by John Bintliff (1985), who tries to relate the Boeotia survey's figures with population densities in prehistoric and Classical times. Starting from the ratio of discovered

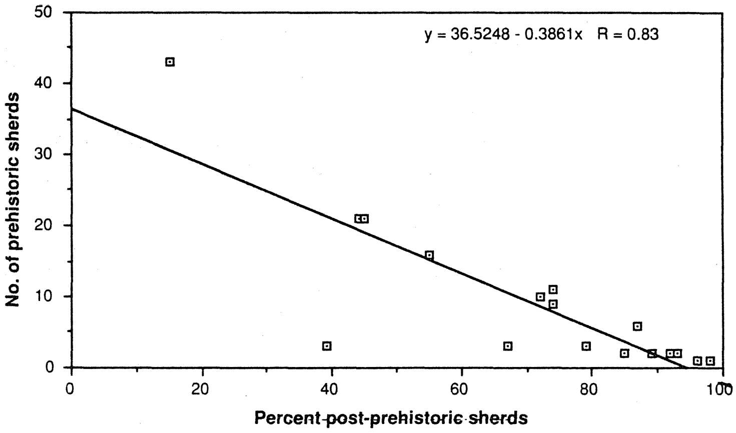

Figure 1.5. The effect of post prehistoric occupation on the quantity of prehistoric material discovered on the surface (from Cherry et al., *1991: 223 fig. 9.7).*

prehistoric/Classical sites in the Boeotia survey and taking into account the length of the periods involved, losses of Classical sites and additional losses for prehistoric sites caused by cumulative site erosion and burial, as well as the differences in carrying capacity between the Classical and prehistoric periods, he concludes that the ratio of expectation to survivors is 96:21 sites for the Bronze Age, its real population thus being lower than that of the Classical period by a factor of 4.5. Also interesting is the work of Di Gennaro and Stoddart (1982: fig. 8) in South Etruria, which shows the relation of discovery of prehistoric sites to the methodological development of archaeological research (such as identification of coarse ware).

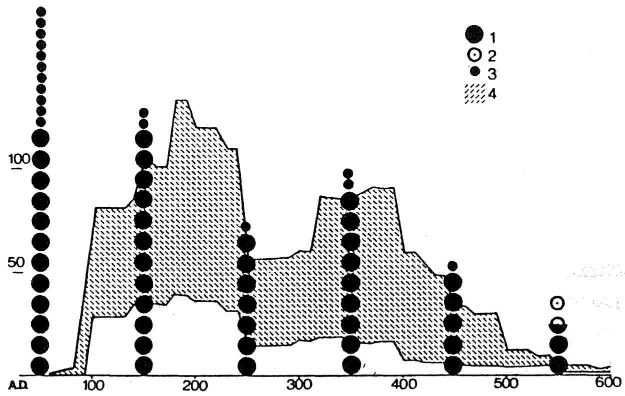

Figure 1.6. Number of sites discovered in the Albegna Valley survey (1. Villa/Villages, 2. Kiln, 3. Farm) against the importation of African Red Slip Ware (4. weighted average) (from Cambi and Fentress, 1989: fig. 1).

Ceramic argument

As the evidence for the existence of sites is based on the presence and dating of ceramics, it is crucial to understand the dating and distribution of the wares and their replacement by others, before we treat the surface artifactual distribution as a basis for the identification of a past settlement pattern. The dating of sites is often based on a few distinctive wares and not on a range of different types. It has to be considered therefore if the absence of certain wares doesn't mean absence of sites, but in fact reflects pottery availability and distribution.

Franco Cambi's and Elisabeth Fentress' (1989) work presents a successful attempt to account for the changing supply of African Red Slip by comparing the ARS falloff with site occupation defined by means of other local wares (Figure 1.6). They argue that the distribution of ARS varies over time in absolute numbers and in location, and that there is a complex relationship between demand and supply. Figure 1.6 shows the total sites (black circles) occupied in the Albegna Valley against the background of the ARS imports (shaded). For the definition of sites, imported ARS as well as rural local pottery (especially for the later centuries), were used. The lower white section of the graph indicates the pottery from a large villa which was considered to be constantly supplied and thus acts as a control on the data from the valley as a whole. The authors argue that the abrupt breaks in continuity in the graph in the middle of the 3rd century seem to have a direct relationship to the supply of ARS and therefore to conditions in Africa. In the graph the number of sites (black circles) appears also to be decreasing but as all sites occupied in the fourth century had pottery from the second it is assumed that most of them were occupied in the 3rd as well, and therefore that the graph falsifies the evidence. The way that the low supply of ARS is falsifying the evidence can also be seen in the fourth and especially in the fifth century when the falloff in the pottery supply is in fact sharper than that in site occupation, which was defined on the means of other, local coarse, wares. In the 6th century the supply becomes so low as to be a very unreliable indicator of site occupation, found exclusively on the coast and therefore not implying the abandonment

of the inland areas in the late fifth and sixth centuries. Millett's work in Catalonia (1991) offers an example of calibration to correct for variable pottery supply.

It becomes clear from these examples, that in order to evaluate the number of sites of each period, we must understand the supply, demand and character of the pottery we are using to date sites. We should also differentiate between different periods and geographical regions, and understand the rates by which wares are replaced by others, or if possible locate the wares complementing the disappearing ones. Surveys without control of locally produced wares are especially at risk.

Chronological filtering of data

Important also for gaining a reliable picture from our data is evaluating them not in their raw form, but transforming them by taking into account various factors which distort the picture. Especially important in some cases is a time-factor analysis, that is the calculation of rates of deposition by taking into consideration the length of each period. Considering the settlement pattern of Melos for example (Cherry, 1979: figure 1), it is important to modify the map of the Early Bronze Age, as that phase covers about 1300 years of island life history; dividing the period by the number of years each site is likely to have been occupied for, results in a low average population for the island in that era, which at first looked densely populated (see also Wilkinson, this volume and Trément, this volume; for a critique of this method see Schacht, 1984: 679). Yet although this standardization by the length of the period will allow more reliable comparisons between periods, it isn't always so easy to solve the contemporaneity problem. Especially when short chronological divisions of periods are lacking and the mobility of a given population considerable it is difficult to evaluate if sites were indeed contemporary or replacing each other in a process of settlement relocation (see also Chapman, this volume and Wilkinson, this volume for discussion of this problem).

Scale of study

There are two factors which affect the degree of variation which emerges from the study of settlement pattern: how broad are the chronological periods and how big is the geographical area considered. It can be argued that lumping of finds into a few broad chronological periods hides interesting fluctuations of short term trends, whilst the consideration of big areas hides the regional variability. This fact can be seen very well in modern demographic work; it is mainly periodic fluctuations from generation to generation that are of importance, whilst looking at the population curve in the long term and on a world scale a completely different picture of stability emerges. In the graphs from Coales' paper (1974: 42) for example, showing the population size and annual growth rate from the emergence of Man till today, the population appears to have been almost static for thousands of years. This picture of stability and slow growth disappears though if we look at a regional example and in the Braudelian medium term (hundreds of years) (Braudel, 1972; Bintliff, 1991b). Much more fluctuation would have been expected if we turned to the short-term of the Braudelian time-periods (changes from generation to generation), which surveys find difficult to define as survey sample errors are greater than real fluctuations.

Although a comparison of the population curve of different survey time-scales and detection of their relationship is aimed at, it seems that Braudel's medium-term (hundreds of years) is the timescale most appropriate for our analysis. Even in that timescale, division of the archaeological periods in subphases might be of importance. In the Kea survey for example (Cherry *et al.*, 1991), a considerable diachronic variation can be ascertained if subphases of the Bronze Age phases are considered, a picture of stability if each Bronze Age period is treated as a broad category.

Moving to a different set of factors affecting the form of the curves, the following social and economic factors should be considered.

Role of the rural pattern in the form of the curves

Producing curves with the total number of sites in different periods is potentially misleading, because these curves contain two kinds of information: i) permanent settlement sites where population lived, ii) behaviour related to rural activities, sites connected with the agricultural exploitation of the countryside. Which factors promote variation in intensity of cultivation or a dispersed artifactual distribution is a question that has to be addressed before we connect the form of a curve with demographic factors. Response to population growth is one explanation of intensification. In the Mesopotamian examples studied by Wilkinson field scatters "occur during phases of either maximum population or maximum urban development", presenting a possibility that at least in these cases land-use intensification was related to population growth (Wilkinson, 1989: 43–44; Wilkinson, this volume: fig. 3). Yet alternative reasons for intensification other than response to population growth, as for example demand to create a surplus for export or tribute must also be taken into account (Cherry *et al.*, 1991: 339, 470–471).

In the Keos survey (Cherry *et al.*, 1991: 340 table 17.4) in order to evaluate the relation between population size and intensity of cultivation the authors compare (Figure 1.7) the population of Koressos town (independent evidence for the population size in the polis centre), number of sites in the countryside (indicative for population size and intensity of cultivation), rate of discard (intensity of cultivation) and geographical distribution of sites (intensity of cultivation).

Period	Rate of artifact discard	Number of components	Distribution of components	Population of *polis**
PG-G	Very low	Very few	Very limited	None or little
Archaic	Moderate	Moderate	Broad	Moderate: 570-810
Classical	High	Very many	Very broad	Extensive: 1020-1455
Hellenistic	Moderate	Moderate	Restricted	Restricted: <495-600
Early Roman	Low	Few	Restricted	Restricted
Late Roman	Moderate	Moderate	Moderate	Restricted

Figure 1.7. Changing patterns of rural activity in Northwest Keos in classical antiquity (estimates for the population of polis of Koressos include both the polis center and its hinterland) (from Cherry et al., *1991: 340).*

Social and economic context

It should also be stressed that the comparison between the patterns of different periods is only meaningful if we compare periods with similar agricultural regimes and stable social and economic contexts. Different conditions have to be taken in account, and discard rates produced by different agricultural regimes must be evaluated. In Roman Greece for example the different discard rates in comparison to the Classical period could be to a great extent attributable to the reconstruction of land use, specialised land use (mono-cropping, animal husbandry) and formation of larger estates (for another example showing a change of land use intensity as a result of a change in the agricultural regime from biennial fallow towards multiple cropping see Wilkinson, this volume; see also discussion in Cherry *et al.*, 1991: 338–339 and 473).

Form of the settlement pattern (dispersed/ nucleated) and population figures

In Greece at least, the results of the most intensive surveys show a settlement pattern which appears to have alternated from a nucleated to a dispersed one and back again. Successive fluctuations in the form of the curve are related therefore to different densities and spacing of settlements and not directly to changes in population. It seems that no consistency exists and independent criteria must be used to control the actual size of the population. Although it could be assumed that a greater number of sites reflects a greater level of land use and therefore an increase in population, it seems that no simple relation exists between settlement density and population size.

A good example of the lack of consistency in this relationship is offered by Runnels and van Andel's (1987) comparison of the settlement patterns of the Melos and Argolid survey. According to Runnels and van Andel's economic explanation (for a critique see Cherry *et al.*, 1991: 461–462, 470–71) although similar economic and political conditions were operating in the two regions, the different natural resources and locations formed opposite forms of settlement pattern. At least in the prehistoric period, periods of prosperity and population growth in Melos produced a nucleated pattern and correspond to growth periods in the Southern Argolid characterised by dispersed settlements. Actually to confuse things in Greco-Roman times nucleation was accompanied by many dispersed sites in both areas.

Another example for the evaluation of the distribution and density of the deposition of artifacts in the countryside is offered by the Keos survey (Cherry *et al.*, 1991: 228–229). There a positive correlation between population size and distribution and density of prehistoric artifacts outside Ay. Irini (the main centre) can be observed during the prehistoric period. As Cherry *et al.* (1991: 229) notice: 'in each prehistoric period for which we find more evidence of material outside Ay. Irini, there is independent evidence from Ayia Irini itself to suggest that the site was growing in size and presumably also in population'. The same holds true for the later Archaic, Classical and early Hellenistic periods that produced substantial quantities of material outside the polis centre of Koressos. Yet when we move to a comparison of the prehistoric with the historical pattern, the density and material distribution of these two broad periods cannot be directly compared to each other and linked to corresponding population levels, as according to Cherry *et al.* (1991: 229, 472–473) a different system of land tenure in the historical periods accounts for the increasing settlement and larger material deposition in the countryside in comparison to the prehistoric periods.

Conclusion

The above discussion shows a considerable number of different factors affecting the form of a gross demographic curve. As a straightforward interpretation is not possible it is important not merely to compare between different curves of numbers of sites over time, treating them as relative population figures, but take the factors discussed into account. Although in a specific context of a regional survey such problems may be dealt with through modification of the curves or verbal explanation, in a wider, sometimes even global scale (cf. for example Whitmore *et al.*, 1990), where comparisons of different regions are attempted, it is difficult to account for all these cultural differences in site density, habitation density within a site, geomorphological problems, and missing sites. Trying to

estimate absolute population numbers will allow us through subjective but explicit adjustments to take into account in a numeric way of the several factors distorting or affecting the number of settlements. Such absolute numbers can further facilitate comparisons between regions on a wider scale through demographic concepts such as density of people/sq. km, density of people/sq. km of cultivated land, growth and decline rates (cf. Whitmore *et al.*, 1990: table 2.1–4; Wilkinson, this volume: table 1). Yet we should treat absolute population estimates rather as relative estimates of the order of magnitude of past population densities, possible only for certain periods or regions when the quality of data allows such exercises. The same applies to further demographic concepts based on absolute population numbers, such as population growth, ratio of rural to urban population, etc.

ESTIMATING ABSOLUTE POPULATION FIGURES

Surveys offer two sets of information which contribute to the estimation of absolute population figures: data from the settlement pattern and data from land use.

Settlement pattern

The following steps are usually followed by the estimation of absolute population numbers on the grounds of settlement pattern.

i) consider the size of the sites,
ii) discuss the contemporaneity of sites, evaluate missing sites,
iii) separate permanent settlements from other sites, and produce a list of number of sites in each functional category for each period,
iv) accept a figure of people per settlement category,
v) multiply by the number of sites.

Determine the *size of a settlement* is a first step toward estimating its population. For excavated sites there are different models to estimate the size of population. For sites discovered from surveys the surface distribution is used to define the extent of the ancient habitation. Methodological discussions consider the degree to which the distribution of remains on the surface represents distribution of materials as they were originally deposited, in order to distinguish between in situ occupation and field scatter. Processes such as deflation of deposits, downslope movement of artifacts and breakdown of artifacts are usually examined. Using the walled area of a city to estimate the size is another method found in the literature, also the comparison of the artifactual distribution with the extent of architectural remains. After having defined the extent of occupation in any particular period, models for the density of population per hectare (based usually on sites with excavated residential quarters where number of houses per hectare can be estimated), are used to come to a figure for the size of the population of each site. Occasionally historic sources are used as well, for urban or urban-and-rural populations in a given territory.

For the *functional analysis* of sites the identification is usually based on size, architecture and finds of the site, though this is quite difficult as small sites especially served different functions through time. A distinction must be drawn between habitational and special purpose sites (see Murray and Kardulias, 1986 for an example of work on modern special-purpose sites and comparison of their size with the size of survey-sites). Further the permanence of the habitation must be evaluated and a set of criteria developed to assess the density of habitation in different classes of sites (cf. for example Kardulias, 1992 for population densities at military sites).

I show as an example of the absolute estimation of the population size, the Classical city analysis for the Boeotia survey (Bintliff, 1997, a) (Figures 1.8 and 1.9). The first step consists in arranging all intensively and extensively surveyed town sites according to size order and dividing them on the basis of size criteria and historic information into 3 groups (Figure 1.8). Group A comprises great cities which usually have dependent small cities and large villages. Group B consists of small cities which are often dependent on group A centres and have in turn dependent large villages. Group C is formed by large villages and dependent harbour towns. Omitting from the truly urban category all sites which are less than 10 ha and adding an estimate for the size of other known sites not shown in the graph (sites where size is only indicated from indirect historical sources), John Bintliff comes to a figure of 967.5 ha for all known town sites and other known sites of at least 10 ha in extent. To evaluate the number of missing nucleated sites not found by intensive and extensive survey he produces a map (Figure 1.9) of ancient village sites (37) and city polis sites (16) known from archaeological work and historical sources. Using the technique of Thiessen Polygon analysis (with standard village module circles of 2.5 km radius) and speculating on the basis of ancient sources and intensive survey that late Classical Boeotia was maximizing land use, he identifies 16 settlement gaps (noted with question marks on the map), where land-use potential and distance from known settlements predict a missing agricultural centre, which he treats in his calculation as 16 hitherto unidentified ancient village locations. As some of these 'missing' foci are likely to be of large village (>10 ha) size, he comes thus to a total of 1047.5 ha for the urban type of settlement bigger than 10 ha. Accepting that 56% of an ancient Greek city was domestic space and a density of 225 persons per ha, he concludes with a figure of c. 131,985 people living in urban/semi-urban sites. Knowing from estimations on the basis of historical sources that the total Boeotian population was of the order of more than 165,500 people, estimations of the settlement organization are made: 79.75% of the Classical population was urban/semi-urban, 20.25% rural (c. 33,515 people), whilst Thebes itself (the regional

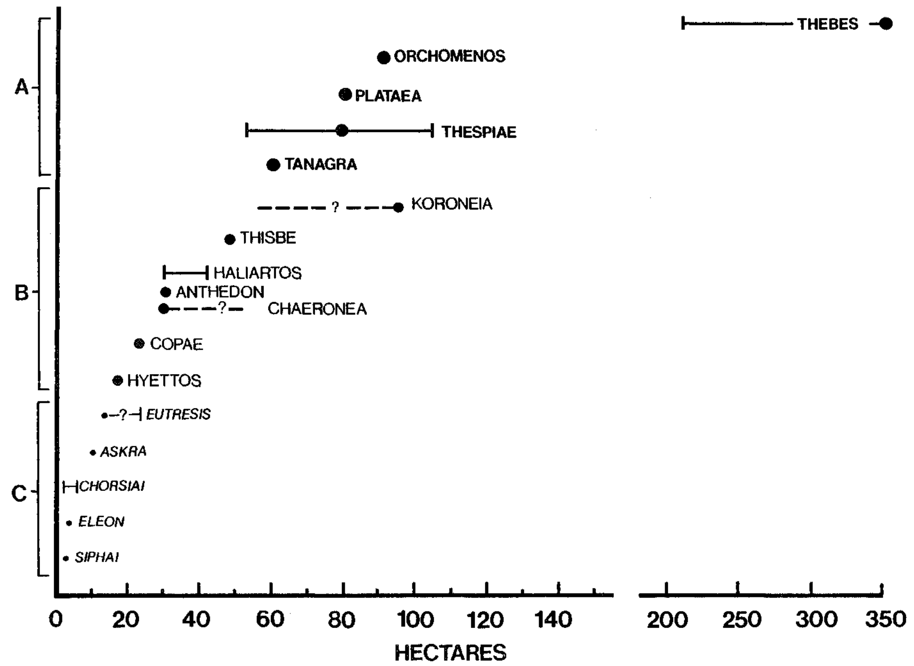

Figure 1.8. Division of urban sites studied by the Boeotia survey in three groups according to site size and historical information (from Bintliff, 1997, a).

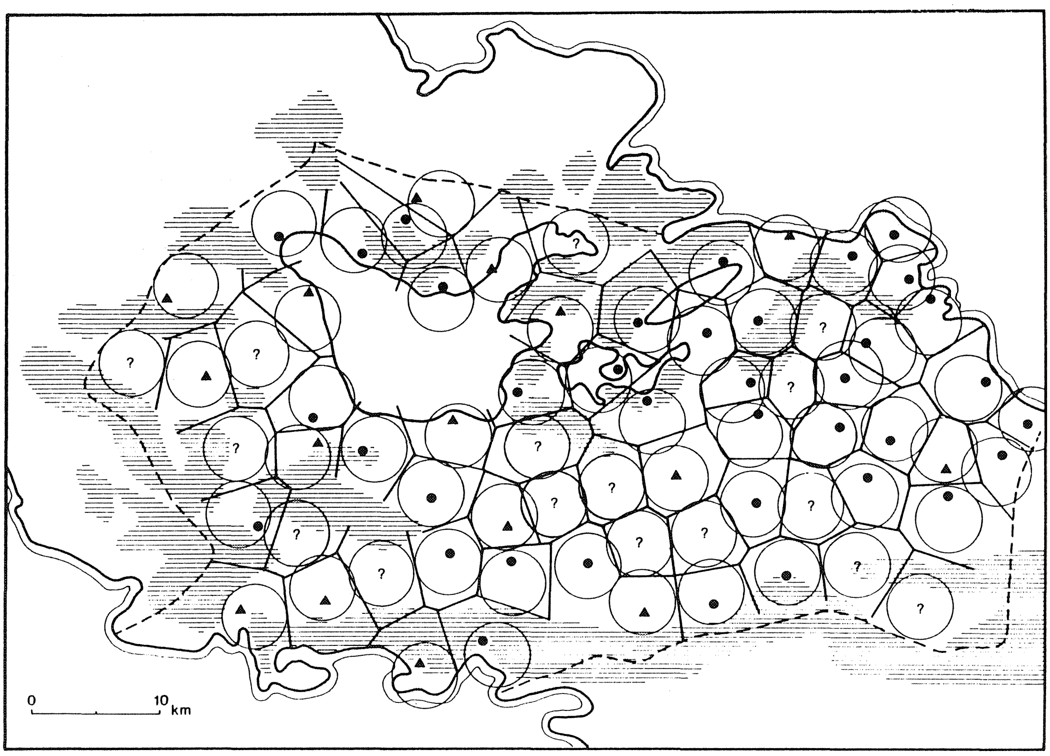

Figure 1.9. Evaluation of missing nucleated sites in the Boeotia survey using the technique of Thiessen Polygons (from Bintliff, 1997, a).

'megalopolis') contained 27% of total urban/semi-urban and 21% of the total regional population. Knowing the area of urban and rural settlements and accepting for ancient Boeotia a percentage of 50% of cultivated land, further demographic concepts such as the ratio of rural population to the amount of arable land can be estimated, being for Boeotia 26.2 people per cultivated km^2 (cf. Perkins, in press [Albegna valley and Ager Cosanus] and Jameson *et al.*, 1994: 539–563 [Argolid] for further examples).

Land use

Apart from period by period maps of sites which can be used to reconstruct a population figure, surveys with off-site data open new possibilities for the study of land use, intensity of agriculture and carrying capacity of regions. It is generally accepted that population size and settlement systems are related to the productivity of the areas sustaining them.

Estimation of carrying capacity gives, though, only a potential figure of the capacity of a region and here lies the importance of survey data, which can give some indications about the actual intensity of land use practised in certain periods in the past. Intensification of land use can be achieved firstly by dispersed settlement or by labour intensive practices such as manuring, terracing and increased application of manpower. Most of these practices can be detected through the analysis of the survey data; the interpretation though is not always straightforward.

We have already mentioned the problems concerning the relation between form of settlement pattern and population size. The variable size of the overall population, which results in the cultivation of larger, more remote and less fertile areas is only one possibility for the explanation of a dispersed settlement pattern. The spatial distribution of finds could also be connected to forms of land use, landholding and social practices in an agricultural regime with residential structures and storage facilities outside residential centres, but with no difference in the overall population size compared to other periods with a lesser discard of artifacts in the rural landscape.

Related in a more straightforward way to the size of the population are labour intensive practices for the intensification of land use, as they are connected with an increased application of manpower. Disentangling the reasons encouraging increased production, e.g. the necessity to feed a bigger population, or the production of a surplus related to an export oriented economy, or an economy producing more to pay tribute, can lead to further inferences about population size.

For practices achieving intensification, some work has been done on the chronology and effect of the construction of terrace systems (Shiel and Chapman, 1988; Moody and Grove, 1990; Wagstaff, 1992; Lohmann, 1992). Dating such terraces is important for detecting the degree of transformation of the landscape at particular times in the past. Methods used to derive the age and origin of terrace systems are the examination of the terrace fills, identification of the possible sources for the pottery found in them and study of the form of the retaining walls (Wagstaff, 1992: 160).

The most important indirect method used to infer zones of intensive farming is the extensive low-density scatter of sherds not associated with in situ occupation (cf. Figure 1.2) and often interpreted as the result of spreading settlement-derived refuse on fields to fertilize the soil and increase production (Wilkinson, 1982, 1994; Bintliff and Snodgrass, 1988; for criticisms see Alcock *et al.*, 1994 with response by Snodgrass, 1994). In examples from the Middle East the sherd scatters were found to coincide with ancient water supply systems (Wilkinson, 1982: 328) or with relict field boundaries indicating the area of previous cultivation (Wilkinson, 1982: 236). In Northern Mesopotamia in conjunction with the field scatters, shallow linear hollows that cross the landscape are interpreted as the courses of former field access roads, and were used as indicators of the limits of site territories and for defining approximate cultivation zones of sites (Wilkinson, 1994: fig. 8). An alternative indirect method to infer zones of intensive farming is that of geochemical traces of waste product zones (Figure 1.10: Thespiae trace elements, after Bintliff & Davis *et al.*, 1990).

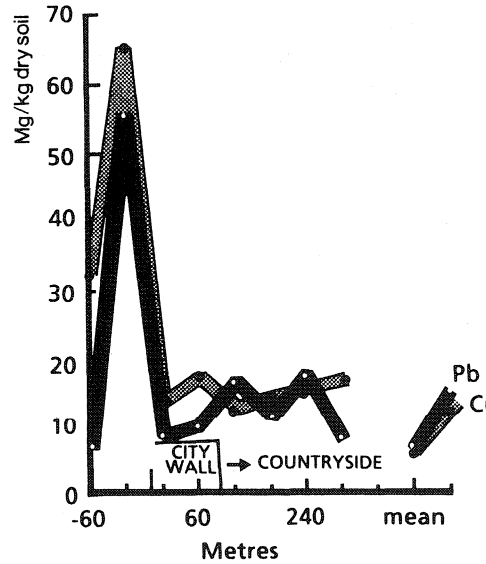

Figure 1.10. Trace metal analysis of the Thespies city in Boeotia (from Bintliff, 1992: 122 fig. 37).

For the estimation of carrying capacity the site catchment (primary farming area) could simply be defined by the sherd scatter. Wilkinson (1982: 332) argues though that although 3 to 6 km radius catchments are defined by the sherd scatters, the overall limit of cultivation could extend further with a zone of un-manured cereal-growing land. In spite of that limitation he argues that either by comparing the ratio of cultivated land to urban land (Wilkinson, 1982: table 1) or by estimating approximately the absolute catchment carrying capacity (cf. Wilkinson, 1994: fig. 13–14), useful information on the relative self-sufficiency of sites can be obtained (see also Wilkinson, this volume).

EXPLANATION OF POPULATION DYNAMICS

After having discussed so far methodological questions for the interpretation of gross demographic curves and

ways of estimating absolute population numbers, let us turn now to another category of demographic issues which can be studied through landscape archaeology: the explanation of population change. Leaving aside the methodological problems connected with surveys and assuming that the curves of settlement numbers across time reflect real differences in settlement density, I would like to discuss what they mean from a demographic point of view (for discussion of the vital rates see Sbonias, this volume).

Relative demographic trends

Detection of relative demographic trends is the basic result of most surveys. The settlement density of different periods is compared and insofar as density is reliable the relative change in the population numbers is identified. Although this level of information seems too simple and the data provided are difficult to quantify and relate to demographic variables, we should stress the importance of being able to detect changes across time. That perspective is often lacking from historical demographic work based on tombstone inscriptions, tax receipts, census data etc., which might give demographic data such as age and sex structure, but fail though to differentiate between periods of time. This results from the way that the average expectation of life is usually being estimated. The following equation is used (Parkin, 1992: 6 and this volume):

$$\text{Average expectation of life} = \frac{\text{Sum of total years lived}}{\text{total numbers of individuals recorded}}$$

All the epigraphic material therefore, giving information on the age of death of various individuals, is treated together and by dividing by the total number of individuals recorded, an average estimation of life (for example for the whole Roman period or the Roman Empire) is being estimated. Apart from other biasses inherent in this epigraphic material (Parkin, 1992: 5–27) a major problem with this approach, as Parkin (1992: 17 and 20) notices, is the fact that it assumes a stationary population, ignoring changes in the rate of population growth and decline as well as migration. Similar problems are connected with the skeletal evidence, as here too a stationary population is being assumed for a given cemetery population.

The survey evidence on the other hand, although lacking data good enough for detailed demographic analysis, can offer information on population dynamics. It could also be argued that this information is more objective than epigraphical or skeletal data based on information about individuals at certain points of time, as this is the result, among other factors, of the effect of the actual and not perceived or commemorated demographic phenomena.

If we accept the reliability of this basic level of information offered by surveys, two points arise. First the question of the timescale, that is the way demographic variables operate at different timescales and the way that this is related to survey evidence. Relevant to this discussion is Ladurie's distinction of demographic phenomena into three categories. He distinguishes between first-, second- and third-degree demographic fluctuations, an approach based on the Braudelian terms of different timescales (short-, medium- and long-term processes) (Ladurie and Goy, 1982: 135–137). First-degree fluctuations, such as that at the end of the Middle Ages (the end of a major agro-demographic cycle), have an enormous impact with consequences spreading over centuries. Second-degree fluctuations lasted between one and four decades and had a significant but less far-reaching impact. The Wars of Religion (1560–1595) or the Thirty Years War are such examples. Finally the third-degree fluctuations stretched over two or three years and are related to sharp increases in mortality due to disease, poverty, and hunger, which could kill about 10% of the population (Ladurie and Goy, 1982: 136–137).

Secondly we should investigate the kind of factors that operate at these timescales controlling or affecting demography. In our analysis the following topics shall be examined:

i) what kind of relationship there is between broad types of social and economic phenomena such as wars, diseases, migration, agricultural production, economy, political factors, local trajectory, and the detected relative demographic trends as reflected in the survey data. Apart from these mainly social and economic aspects can we also include in the discussion demographic variables, as for example changing levels of mortality and fertility and validate the survey results by modern demographic techniques? (see Sbonias, this volume),
ii) what is the impact of the demographic consequences of such phenomena on the landscape? How does the distribution of settlements vary across space and time according to these factors, and
iii) how much of that information is revealed through archaeology?

In the present paper following the main distinction of short/medium- and long-term fluctuations I will present some thoughts on ways to link settlement curves to factors controlling or affecting demography.

Migration and population displacement

Movement of people is an obvious factor affecting demographic distributions. Colonisation and foundation of new cities, movement of whole peoples, as well as the relation between urban centres and rural areas can be mentioned. Historical evidence documents such events either directly through ancient writers or indirectly in the form of epigraphic material. I show as an example (Figure 1.11) the epigraphic distributions of local and Italian immigrant

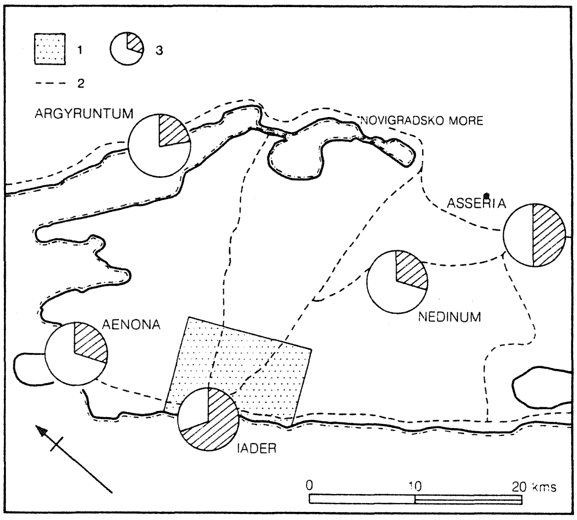

Figure 1.11. Epigraphic distributions of local and Italian (Nr 3) names in the Roman Ravni Kotari, Dalmatia (from Chapman and Shiel, 1991: fig. 2).

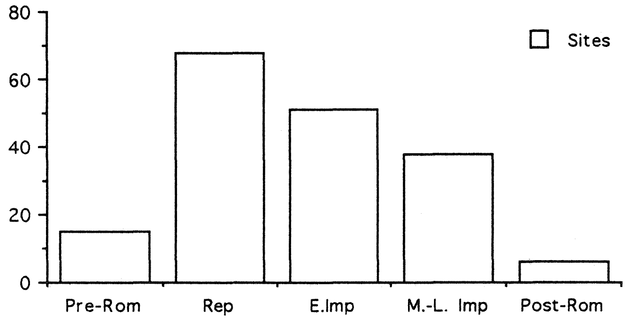

Figure 1.12. Sites found by the Ager Cosanus survey (Dyson, 1978: fig. 4–5 and Appendix).

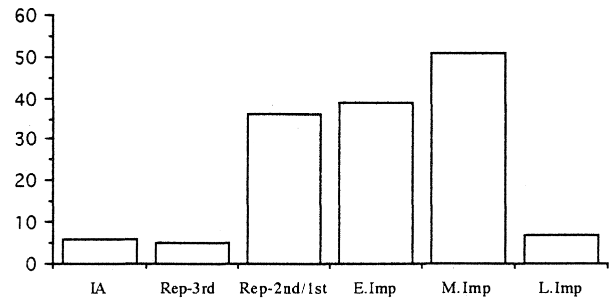

Figure 1.13. Sites found by the Lower Liri Valley survey (Wightman, 1981: fig. 23.2–23.5).

names in Roman Dalmatia, showing a higher proportion of Italian names in sites of a colonial status such as Iader (Chapman & Shiel, 1991: 64–65). When such evidence is available, the possibility opens for comparison with survey results.

Examples to monitor how the migration into an area shows up archaeologically, are offered by many surveys in regions where Roman colonisation changed the local demographic landscape. In Spanish Turdetania, for example, survey results show the development of roman rural settlement during the early imperial period, reflecting a change in the rural exploitation and linked to the foundation of roman colonies, redistribution of land and agricultural exploitation for commercial purposes (Keay, 1992: 303–309). In such situations it may be difficult to separate the impact of immigrants from a rise in the local population stimulated by the Pax Romana.

In another example, the Ager Cosanus in Italy (Dyson, 1978), a sparse settlement existed in the period before the roman colony of Cosa, founded in 273 BC (Figure 1.12). Looking at Figure 1.12 the difference between pre-roman and republican settlement density is apparent and one could argue that what we see here is the result of the foundation of the colony and of the new settlers arriving. Dyson's remarks though on the number of settlers, the date of the foundation of the city and date of the sites found, show the failure of the survey to detect the results of the colonisation at the short term level. Dyson (1978: 258–273) mentions that the original number of the colonists was probably 2,500–4,000 families or 7,500–12,000 settlers, with another 1000 families following in 197 BC, and speculates that as only a limited part of these could be settled in the city, an expansion of settlement in the countryside should be expected. Contrary to expectation, though, most of the pottery is dated not to the early period of the colony but later in the 3rd and 2nd centuries BC. In that case therefore the survey fails to notice the original migration of a large number of settlers, that is the short-term event. Dyson observes that many of the settlements would have been short-lived and attributes the failure to find them to the nature of sites that could be found by surveys. Attolini *et al.* (1991: 144) noticing also in a more recent survey in the Ager Cosanus the absence of settlements around Cosa in the early 3rd century BC, interpret it with the assumption that the coloni were living within the walls, the unoccupied northern part of the territory serving as *ager publicus*. A more direct link between colonisation and survey settlement pattern in the same area can be seen for the 2nd century BC, as the dense rural settlement observed in the survey during this period could be related to the resettlement of Cosa in 197 BC and the foundation of Heba in the middle of the century (Attolini *et al.*, 1991: 144).

A similar difficulty to trace 3rd century sites can be seen in the results of the Liri valley survey (Figure 1.13). The sites found seem to belong to the 2nd and 1st centuries BC and not to the mid 3rd century, the time of the arrival of the new settlers. According to Wightman (1981: 281–282) the pottery of the 2nd to 1st centuries BC found by the survey seems to be the result of the construction of solidly built villas during this period, the survey failing thus to detect the previous period with a different kind of site.

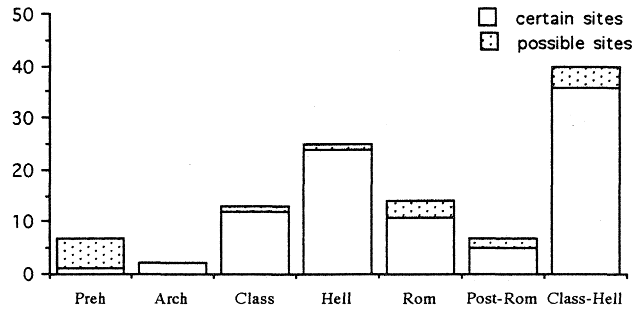

Figure 1.14. Sites found by the Aetolia survey (Bommeljé and Dorn, 1984: table 1).

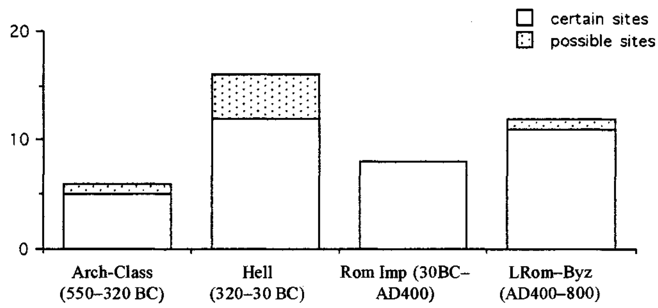

Figure 1.15. Sites found by the Heraclea Minoa survey (Wilson, 1981: fig. 20.1–20.4).

We could say therefore that in these two examples the long-term impact of roman colonisation, spreading over centuries, definitely shows up on the landscape, but with unreliable results in the short-term, a failure connected mainly not to the time scale but to methodological problems of recovery of sites and visibility of ceramic for certain periods.

Another example of population movements as a response to the restructuring of the landscape by the Roman imperial power is presented by Alcock (1989: 99, fig. 2 and 3) in her discussion of the foundations of the Greek cities of Nicopolis and Patrae. In order to develop a more efficient infrastructure new urban centres were created through transference of large territories to them, destruction of old villages and relocation of whole populations. Alcock mentions that according to Pausanias the Aetolian population fled to Amphisa to avoid transfer to the new foundation of Nicopolis, and makes a possible link between that disruption and the differences in the density of sites noticed in the Aetolia survey between the Hellenistic and Roman Periods (Figure 1.14). Bintliff (1997, b) on the other hand, considers such military factors as only one of various set-backs leading to the collapse of the Hellenistic florescence in Aetolia. The population growth in that region during the Hellenistic period is considered as a short episode of dramatic population increase, typical for mountainous regions characterised by long term periods of stability and shorter episodes of unusual growth during a period of intensive external interaction with the lowlands.

In the above examples a direct link is made between the form of the curve and the demographic factor, that is migration to or from an area, based on the existing historical evidence on population movements. A question to be raised is whether the rate of the change as shown by a survey, points to demographic changes resulting from population movements as opposed to inherent demographic factors like mortality and fertility. To evaluate this, demographic theory should be used in combination with evidence from physical anthropological data on the mortality rates and sex structure, in order to see whether these factors would allow for a population to have grown or decreased at the observed rate.

Warfare

Another area for investigation is the demographic effect of recurrent warfare and insecurity, leading to high mortality rates, population movements, destruction of agricultural production and economic retrogression. These and other interrelated phenomena such as heavy taxes, abandoned land and easy spread of diseases through the movements of armies could decimate the population (Wrigley, 1969: 64). Historical evidence on that topic is abundant. Brown (1984: 40) cites for example a passage from Pope Gregory the Great's Dialogues, which shows the demographic consequences of the Lombard invasion as perceived at that time:

> "Now the cities have been depopulated, fortresses razed, churches burned down, monasteries and nunneries destroyed, the fields abandoned by mankind, and destitute of any cultivator the land lies empty and solitary. No landholder lives on it; wild beasts occupy places once held by a multitude of men."

Of course the evidence of such historical sources must be evaluated critically and surveys do offer independent evidence to compare with such historical information. We should also ask on which level such consequences of warfare operated. Ladurie stresses war as a crucial factor in the fluctuation of agricultural product, connecting it with short- and medium-term slumps (Ladurie and Goy, 1982: 89–90). Alcock (1989: 107–108) notices that warfare in pre-industrial societies is being denied any long-term effects. However, in the archaeological bibliography when a decrease in the number of sites is noted and historic information on wars in the area exists, a direct linkage between these two phenomena is often made. So for Heraclea Minoa, Wilson (1981: 256) seems to connect the Civil wars of the late Republic in Sicily (late 40's and 30's) with the abandonment of Heraclea Minoa by about 30 BC and the desertion of the suburban sites and rural farms (Figure 1.15). In Boeotia the destruction of Haliartos by the Romans in 171 BC had a long-term effect, as the city was not reoccupied and the countryside didn't recover till the Middle Byzantine period (Bintliff, 1991a: 124

and 126, 1992: 108). In another example Brown (1984: 42), discussing the warfare initiated by the Lombard invasions mentions the settlement pattern of the 6th to 8th centuries AD discovered by the South Etruria Survey, characterised by a concentration of settlement in a small number of inaccessible sites and seen probably as a result of insecurity. Christie (1989) although acknowledging the impact of warfare, draws a more complex picture of economic collapse, self-sufficiency and social change leading to nucleation and a shift to defensive locations. The Albegna valley survey offers another example where the destruction of the city of Doganella by the Romans around 280 BC is reflected in the severe population decline detected by the survey (Perkins, in press). This case study also illustrates the short/medium term effect of warfare, as the population levels in the valley rapidly returned to the pre-conquest levels (Perkins, in press).

Epidemics

Epidemic disease as a factor in demographic phenomena, acting independently or decimating the population in combination with other factors such as wars and famines, can operate in the short- and medium term or in the long term as the plague during the Middle ages. Figure 1.16 shows the effects of the two great plagues starting in AD 542 and AD 1348 respectively on the course of Mediterranean population (Russell, 1985). The first plague of 541 which recurred till the 8th century, resulted in population loss of around 40 to 50% (Russell, 1985: 169–171). Following the decline of the plague, in the period 700 to 1000, the population rose to pre-plague levels and continued to rise, reaching a peak between AD 1280 and 1310, an overpopulation ended by the reappearance of the bubonic plague in 1347/48 (Russell, 1985: 196–198). Of note are the uneven death rates during these plague periods, with attacks following at constant intervals and the mortality being in interplay with modified demographic practices and customs to counterbalance the population loss.

Skeletal studies provide evidence for the immediate effects of such diseases in the past (cf. Russell, 1973;

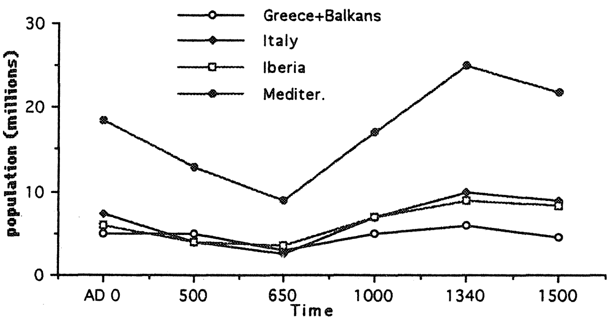

Figure 1.16. Estimated course of the Mediterranean population (Russell, 1985: 36 table 6).

Davies and Walker, 1993; Verano and Ubelaker, [eds] 1992). Parkin's discussion of the devastation brought by plague in Egypt and described by Dionysius bishop of Alexandria around AD 261/62 shows ways that the impact of certain diseases can be estimated when historical information is available (Parkin, 1992: 63–64 and this volume, table 1). On the basis of Dionysius' account that in AD 261 the people aged 14 to 80 years were fewer than the people aged 40 to 70 years at an earlier time, Parkin estimates a fall of 62% of the original population, possibly operating in the short term, as otherwise in the long-term the population of Alexandria would not have survived (see though Parkin's scepticism on the validity of this information, this volume).

The Albegna valley survey is an example of a survey using epidemics as a factor. Here the population of the valley during the time of the Black death is thought to have fallen below the minimum required to assure its own survival, leading to the complete desertion of the region (Cambi & Fentress, 1989).

Population and fluctuations in agricultural production

There is certainly a link between demography and events such as famines, food-shortages and subsistence crisis. For recent periods data on agricultural production have been studied from a demographic perspective. Ladurie's work on tithe is an example (Ladurie and Goy, 1982), based on the assumption that fluctuations in agricultural production kept pace with changes in the population. An example can be seen in Figure 1.17, which presents the fluctuations in the product of the tithe in Cámbresis from the 14th to the 17th century. Interesting is the fact that Ladurie links these fluctuations with different kinds of phenomena. The long-term changes are slow changes in productivity connected with the overall changing levels of population (Ladurie and Goy, 1982: 87). The medium-term changes are connected with war and epidemics, leading to abandonment of land and subsistence crisis. In Figure 1.17 the medium-term fluctuation of 1340–50, marked by war devastation in the 40's and followed by plague in 1348, led to widespread decline of population, decline in grain production and shortage of food. It initiated, according to Ladurie a long-term depression which lasted till the 18th century (Ladurie and Goy, 1982: 87), interrupted in the graph by other medium-term crises (1415–27, 1476–83, 1523–30, 1553–60, 1580–90=Wars of Religion).

In archaeology we cannot of course follow the agricultural production year by year. Off-site data from surveys though do open new possibilities for the study of land use and agricultural production. Practices achieving intensification of land use, such as dispersed settlement, or labour intensive practices such as manuring and terracing can be detected through the analysis of the survey data, giving indications about the actual intensity of land

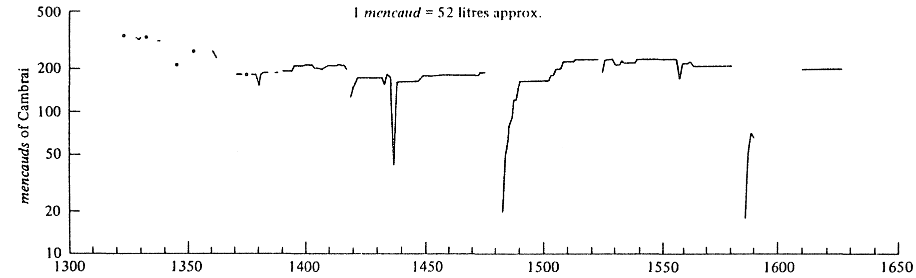

Figure 1.17. Tithe and terrage *in the Cambrésis, 1320–1630 (Ladurie and Goy, 1982: fig. 3 after H. Neveux,* Le grains du Cambrésis, *Paris, 1980: 62–63).*

use practised in certain periods in the past. Fig. 1.7 presents the changing patterns of rural activity in Keos, as observed in the rate of artifact discard discovered by the survey (Cherry *et al.*, 1991). It is remarkable that these changing patterns are in accordance with the distribution of sites and estimated population for the broader polis. Indirect methods used to infer zones of intensive farming, such as the extensive low-density scatter of abraded sherds not associated with in situ occupation, or work on geochemical traces of manuring zones to infer zones of intensive farming have already been discussed. Environmental studies being conducted in most modern surveys provide additional information for changes in the environment (see Treménť, this volume).

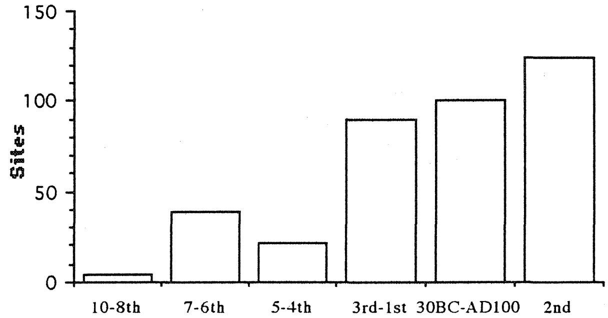

Figure 1.18. Sites found by the Ager Capenas survey (Potter, 1979: tables 2–6).

Regional differences in development

Apart from the external factors already mentioned, we should also look at the local trajectory in order to evaluate demographic fluctuations or differences between regions. An example of such differences is given by the situation in Italy in the first century BC as seen in the results of various surveys in Samnium, South Etruria, Ager Cosanus, Albegna Valley, Magliano, Liri and Luni. Patterson (1987), summarizing the results of these surveys finds a variegated pattern, thus not accepting any concept of country-wide crisis in the later part of the 1st century BC. Moreover, in the Ager Capenas and Liri Valley for example (Figure 1.13 and 1.18) a marked increase in the number of sites is noted in the 2nd and 3rd centuries AD, whereas in parts of South Etruria, in Molise and Cosa (Figure 1.12) a decrease is recorded at that time or even earlier. Wightman (1981: 286) notices that:

> "such regional differences must be seen as an interplay between various natural and incidental historical factors. On the one hand is the topographical and pedological potential of the area, on the other certain specific historical events or trends – the nature of initial settlement, periods of population expansion or loss, formation of a stratified society, in some cases artificial interference such as the creation of a Roman colony".

As what we take from the survey results is differences in the number of settlements, the question is how we could detect from such differences hidden demographic fluctuations.

Patterson, discussing the increase in the number of sites in the Ager Capenas (Figure 1.18), draws attention to the alimentary schemes set up in various areas of Italy, a reflection according to him of the widespread rural poverty in these areas (1987: 139). As such alimentary schemes were set up at Capena he supposes the existence of rural poverty in this area, and sees the increase of the number of sites and expansion of cultivation shown by the survey, as an indication of the existence of impoverished peasants cultivating previously unused land. In this case an increase in the number of sites is interpreted as the result of a demographic and economic crisis connected to poverty and leading to the expansion of agricultural land. A functional analysis of these sites with a study of the nature of finds and of the possible imports could further evaluate the status of these farms.

The opposite effect of decreasing number of sites during the 1st century BC to 2nd AD is found in areas with links to the markets of Rome, such as Ager Cosanus (Figure 1.12). Patterson (1987: 140–141) links the amalgamation of properties and agglomeration of estates that took place in these areas, with a possible migration of the rural population to the cities.

In the above examples therefore two different forms of curves could be connected with the same demographic

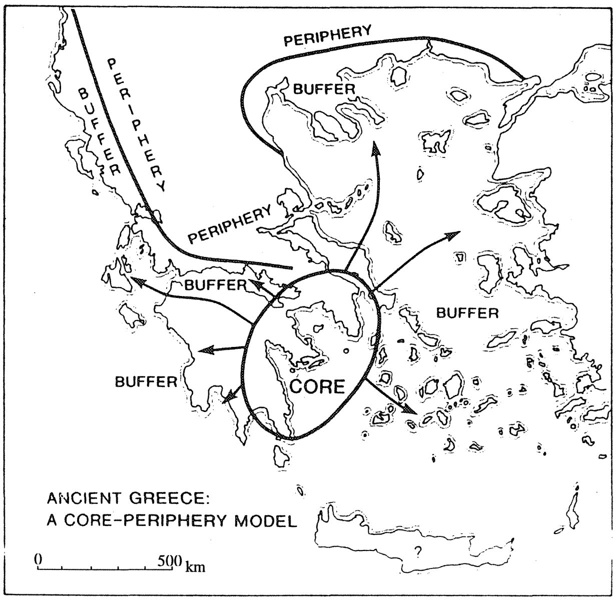

Figure 1.19. Diverse ancient greek regional developments and core-periphery model (Bintliff, 1997, b).

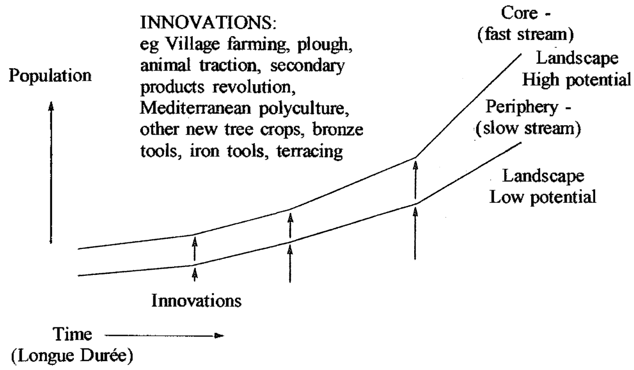

Figure 1.20. The importance of innovations for the Malthusian model (Bintliff, 1997, b).

crisis. In inland areas with no particular connections with the markets of Rome and with prospering elites, the crisis led to the impoverishment of the rural population and to its expansion in previously unused lands. In areas with close trading links with Rome agglomeration of estates led to the migration of the population and probably to its overall decrease, as cities are affected by the population changes of the countryside (Russell, 1985: 170).

The kind of phenomena discussed so far, such as wars, diseases and famines, generally seem to cause short and medium term fluctuations, having no severe effect in the long term. Wrigley (1969: 15, 68–69) notices that extreme situations in pre-industrial societies were found in the short-term, fertility and mortality counterbalancing the original change. So although in bad years death rates could be locally as high as 200–400 per 1,000 (Wrigley, 1969: 62), no more than a few generations are needed for the population to return to its previous structure. Years following a crisis tended to have lower mortality as the vulnerable population had already died and were accompanied by a higher birth rate as postponed marriages tended now to take place. Generally such years of heavy mortality were periodical, with cyclical occurrence of population growth and severe checks, either incidental or of a Malthusian type. In the long term the population remained stable. Concerning archaeology and survey data it seems almost impossible to follow these short-term population fluctuations and see how they relate to phenomena such as famines and agricultural production, wars or diseases. It seems also difficult to investigate the way these short-term fluctuations interrelate with general social and economic variables in the local trajectory to initiate or affect long term trends.

Long term – Modelling population dynamics

Turning to the long term, we should stress that it is at this level that cycles of population growth or decline can be detected in archaeology. Of particular interest is the detection of points in time when not mere fluctuations but changes in the population ceiling can be observed. As the causes of such changes are general structural differences in the society and economy or the environment, it can be argued that landscape archaeology can prove particularly powerful in studying the long-term demographic trends. In that level it is on the basis of various models that the observed patterns are interpreted.

John Bintliff (1997, b and this volume) trying to interpret diverse regional developments in Archaic to Late Roman Greece uses among others the following two models. According to the core-periphery model (Figure 1.19) South-East Lowland Greece is seen as the core with peripheral regions "coming under its progressive dependency for manufactured items and luxury goods in return for primary products". In figure 1.20 on the other hand the importance is stressed that the Malthusian model lays on innovations, such as village farming, secondary products revolution, Mediterranean polyculture, bronze and iron tools etc., leading to cycles of expansive population growth. Generally he suggests that these models operate in combination within a particular region (see Bintliff, this volume).

Another example operating in terms of the Malthusian model, and underlining the role of the equilibrium between population size and resources as a factor, is presented by the Albegna valley survey (Cambi & Fentress, 1989). Here the small number of 12th century sites was in relative equilibrium with the productive possibilities of the valley under the 12th century economy, which aimed totally at subsistence with negligible exchange and a pattern of an incastellated landscape. The equilibrium of Roman times on the other hand was characterised by a market economy and intensive agriculture.

An example which tries to model the equilibrium between resources and population is presented by Wilkin-

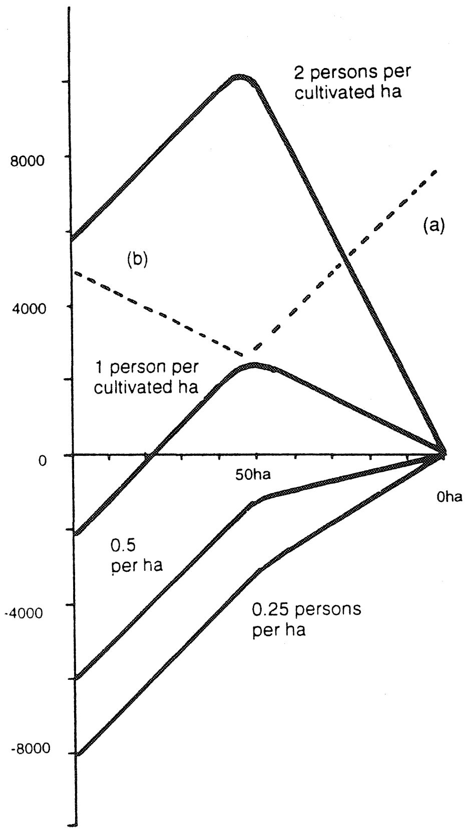

Figure 1.21. Change of surplus or deficit crop production, expressed in terms of the number of persons that the cropped land could support, according to labour supply and size of site for hypothetical 5-km-radius territory. Individual graphs indicate productivity levels employed (Wilkinson, 1994: fig. 11).

son in Figure 1.21 (Wilkinson, 1994). The model examines how a given North Mesopotamian settlement may grow in relationship to the productive potential of its surrounding territory. As the settlement increases in size and population, its potential productive capacity also increases. However with growth in population the available labour will eventually exceed the labour required, as the increased population is not matched by a potential growth in available land. Therefore after a peak of the total production there follows a decline of surplus production. According to Wilkinson's model for a site catchment of 5 km radius the site will suffer a deficit when population exceeds 6000–8000, which would be accommodated in an area of 60–80 ha. The individual curves in the graph indicate different productivity levels, predicting that a minimum yield of 0.66 persons fed/ha is required to support the population. The model suggests that as population of the central settlement increases beyond a critical point either in density (for example 200 persons/ha) or in size (in the settlements of upper Mesopotamia discussed by Wilkinson 50–60 ha), unless the site territory can be increased in size, it will be necessary to increase

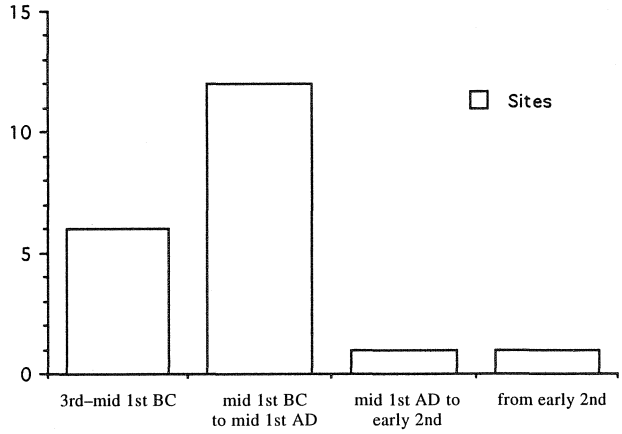

Figure 1.22. Sites found by the Ager Lunensis survey (Delano Smith et al.*, 1986: table 3).*

production by intensification (raising crop yield per ha) or by importing surplus production from other secondary centres or satellites (see also Wilkinson, this volume).

The example of Luni (Figure 1.22) stresses the role of the economic context and especially of the trading system as a factor explaining differences in population density (Delano Smith *et al.*, 1986). The area is characterised by its poor agricultural potential, which is reflected in the absence of settlements in the prehistoric and medieval period. The level of the population density in Roman times is interpreted in the perspective of Luni's role as a centre of administration and as a port for long-distance commerce, a potential lost in Late Roman times with the collapse of the overseas market and specialised production (Delano Smith *et al.*, 1986: 141–143; Mills, 1981).

The Piacenza survey draws upon an ecological model to emphasize the importance of population size for the maintenance of the ecological balance of a region (Dall'Aglio and Marchetti, 1991: 166). In the area of Piacenza the general economic and population decline in late antiquity and the interrelated abandonment of the infrastructure (farms, terraces etc.) is thought to have destabilised the ecological balance of the area, leading to the formation of marshland in the plain and landslides in the hills, resulting in the abandonment of the city of Veleia and the desertion of the region in the long term.

In another example Barker draws attention to the Boserup model to explain the transformation of society in central Italy in the mid 1st millennium BC (Barker, 1981: 220). The increasing population levels observed in Etruria and Molise by the end of the prehistoric period are thought to have transformed the traditional neolithic farming system towards a more productive and labour intensive one.

Generally we could argue that archaeology has a particular potential in the explanation of long term population changes as they are observed in survey data. It could also be claimed that survey data offer a satisfactory level of detail for a discussion of general demographic models.

CONCLUSION

Three broad areas of research have been discussed in the present paper: a critique of survey data and a discussion of methodological problems; the estimation of absolute population numbers on the basis of survey evidence and other interrelated historical and archaeological evidence; and third an attempt to link the relative demographic trends observed in surveys with demographic mechanisms and interpretive models. This work has emphasised the level of general trends, that is usual in archaeology, using some additional basic demographic concepts and a demographic point of view. It shows the contribution of landscape archeology in studying demographic patterns but also the limitations that survey data pose for a discussion based on modern demographic techniques. Data on births and deaths or treatment according to age and sex are very rarely available and thus we cannot say on the basis of landscape archaeology from what kind of vital events in the long term the observed changes have resulted. It is for that reason important to link survey studies with other work in historical demography and physical anthropology and discuss how changes in the size and structure of population aggregates translate into changes in the structure of the settlement pattern.

Historical demography and physical anthropology are different areas of research with their own problems, techniques and level of detail in the demographic discussion, which eventually could permit a link of the survey curves with a whole range of demographic issues. A cross-disciplinary approach linking the evidence of these three research areas could contribute further to the study of demographic patterns. It poses the most difficulties considering the fact that the majority of surveys do not discuss these topics, that these data operate at different timescales and that the sample size of inscriptions and of skeletal studies is rather small. The papers in the second part of the volume illustrate ways that we can profit from such cross-disciplinary approaches.

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As organisers of the Durham Colloquium, we aimed to bring together notable specialists in regional field survey, historical demography and the palaeoanthropology of cemeteries, in order to present the main achievements of each of these fields and their growing convergence in the analysis of long-term population dynamics. Although most contributors were researchers in Southern Europe, we invited several international specialists whose methodological and theoretical expertise was significant for the general theme of the Colloquium, although their research areas were extra-European.

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2. Regional Field Surveys and Population Cycles

John Bintliff

INTRODUCTION

Before consideration of demographic trends detectable via survey, it is necessary to tackle the question of methodological hindrances in deriving demographic inferences from surface archaeology. Constructing demographic history is certainly not conceivable from surface remains alone, but this equally holds true of excavation, historic sources and other proxy data for 'people on the ground'.

It is important that field surveys maintain an appropriate sense of autonomy from other sources of evidence in the first instance, to allow a degree of mutual comparison and contradiction to work positively towards greater methodological refinements in each approach. On the other hand, the 'cumulative credibility' of a convergence of approaches on a common viewpoint is one of the strongest arguments for approximation to reality in reconstructing past population levels. A good instance of this is the clear and recurrent statement of the historian Polybius, that in his time (2nd century BC) Southern Greece was suffering from depopulation. Tied as this was to that historian's moralistic worldview on the cyclical rise and fall of nations (and with the ascendency of Rome in his mind), ancient historians have traditionally doubted the value of Polybius' picture. When intensive survey in Southern Greece found a widespread trend for the abandonment of rural farms and a parallel contraction in the occupied area of urban sites (Bintliff and Snodgrass, 1985, 1988), Polybius and other early Roman era writers underwent a revaluation. Understandably concerned to ensure that survey has not in turn been overinfluenced by the historical sources, Sue Alcock (1993) has revaluated the survey data, challenging it to disconfirm depopulation. The survey data come through very strongly as evidence for depopulation, and even the rare exception where early Roman Greece shows localised growth at this time, the Nemea Valley Project's urban survey at Phlius, can be called into question (Bintliff, 1997, a) as the product of unintentional bias in survey methodology.

In my contribution to the Pisa Conference (Bintliff, in press, c), and my joint paper with Kostas Sbonias to the Siena Conference (Bintliff and Sbonias, in press), in this Populus series, I have dealt with the numerous methodological hurdles that must be faced up to in translating field survey results into a series of period maps exhibiting identified or postulated settlements and associated forms of human activity across the landscape. I will not rehearse these issues here, but merely cite my conclusions:

a) With appropriate research into the quantitative and qualitative characteristics of surface artefact distributions, and a mode of fieldwork ensuring high resolution data, together with vegetational and geomorphic filters, one can expect to produce distribution maps with a high degree of confidence in the reality of what is being displayed.
b) These maps are, *nonetheless*, acknowledged to be partial, – palimpsests of the original complement of settlements and other activity foci. The degree to which gaps in the distributions exist is likely to depend very much on the size, age and type of site. It can be argued empirically that larger and more long-lived sites are far more likely to be represented than smaller, more short-lived sites, whilst sites of increasing age are less likely to be represented; likewise sites of recent plough-damage exposure are more likely to be represented than those long-exposed to such practices.
c) A due sensitivity to the measurable effects of these negative and positive factors, especially those concerning size and age, can allow us to increase the refinement of our interpretations, especially towards vestigial site exposure (where only part of a site is exposed to view), as well as highlighting classes of site likely to be differentially represented in the record.

Revisiting, and site case-study analyses, utilizing highly intensive site-based survey grids and ancillary aids such as geophysics and geochemistry, can assist the inter-

pretation of problematic classes of site. I have dealt with these necessary procedures in detail in my Pisa and Siena contributions.

In an ideal situation therefore a nuanced interpretation of site distribution for each phase is feasible: the location of domestic sites – large and small, from farm to village to city, the spread of complementary activities such as agricultural manuring, animal shelters, quarry sites, cemeteries and shrines. In parallel we should be in a position to comment on the degree of representativity of each activity type/site type in the landscape. Thus we could assert with confidence from an intensive survey that all towns were known, maybe all villages, whereas farms and even smaller activity foci may be a fragmentary distribution requiring notional estimates of missing sites based on various criteria.

What indeed might these criteria be? No correction factor is very absolute, since other sources of information contain their own possibilities of error.

- Revisiting of sites and transects over a number of years may provide quantitative evidence on the frequency with which new sites emerge in previously 'barren' localities (due to cultivation, vegetation and other changes), and the changing shape of known sites in different years. However we do not have a means to calculate how many revisit years would be required to discover all the sites potentially recoverable from surface study! In any case, we are aware that some sites are effectively lost to our study through burial, violent erosion or permanent vegetation obscurance. Perhaps 'guesstimates' may be made for these using geomorphic and pedological expertise, or 'windows' into conditions within such zones of site invisibility (a 'window' being a small sector of good survey conditions within a zone of very poor conditions).
- Another alternative is to employ historic population estimates as a comparison to populations calculable purely from (a) settlement density recorded directly by survey, and (b) reconstructed population density using correction factors such as those noted above. Many archaeologists would consider the ways in which ancient and medieval authorities estimated population were coarse and of doubtful validity, but there usually exists a well-founded historical approach to the possibilities as well as limitations of pre-Modern population estimates that can be used, often with its own correction factors, to create order of magnitude population figures for regions, districts, towns and villages.

I have recently carried out one such exercise for the province of Boeotia in Central Greece, in the 4th century BC (Bintliff, 1991; Bintliff, 1997, b). I attempted to use contemporary population estimates, both to analyze the implications for regional food production and to make direct comparison with the density of rural and urban population recorded by intensive regional survey. Acknowledging that the survey results for the small-site size category excluded a significant component of missing sites, and calculating urban and village populations from their visible site areas, I suggested very provisionally that perhaps half of the rural farmsteads of this period had remained undiscovered by our survey. This was a figure compatible with the frequency of new sites recorded through revisiting parts of the surveyed landscape in successive seasons (cf. Barker and Symonds, 1984; Barker *et al.*, 1986 for comparable insights from survey in Italy). From these considerations one might calculate that some 70% of the population were town-dwellers, 30% were farm and village-dwellers in this period. The importance of such a high level of urban population reinforces the centrality of city-state life to Classical Greek society. It also helps us to put the loss of information concerning small sites into context and scale, as their total contribution to population was less than 30%. The reverse would however be the case in the Bronze Age, when we would suggest that a majority of the population lived in small- to medium-sites that are subject to underrepresentation even with intensive survey. My own radical opinion at present would be to suggest that all published 'maps' of Bronze Age sites in Greece are without quantitative meaning and can merely be used to reflect qualitatively the spread of settlement across regions; no demographic reconstructions are justifiable at present. The underrepresentation of prehistoric sites is exacerbated by the long time periods which chronological coarseness enforces on us, so that it is unclear if six Early Bronze Age sites represent as many contemporary settlements or a single settlement relocating, or being replaced at intervals, every 1–200 years around the landscape (Cherry, 1979).

SURVEY AND DEMOGRAPHIC INFERENCES: THE CASE OF REGIONAL CYCLES

We have now confessed to the numerous practical and theoretical difficulties we encounter in seeking to address demographic questions from regional surface survey. Provided we acknowledge the highly provisional nature of our conclusions and constantly revise our procedures, we can and should continue to construct population estimates and explore their implications for understanding past societies.

In the present state of knowledge, one of the most striking and interesting results of Mediterranean field survey has been the empirical recognition that most if not all regions, considered in the long-term, bear witness to cyclicity of population. Site numbers alone are not adequate to prove this, and we must take note of site size and site contemporaneity. Nonetheless the pattern appears to be universal and regular and invites commentary by, and engagement with, historical demographers, geographers, documentary historians, palaeopathologists and

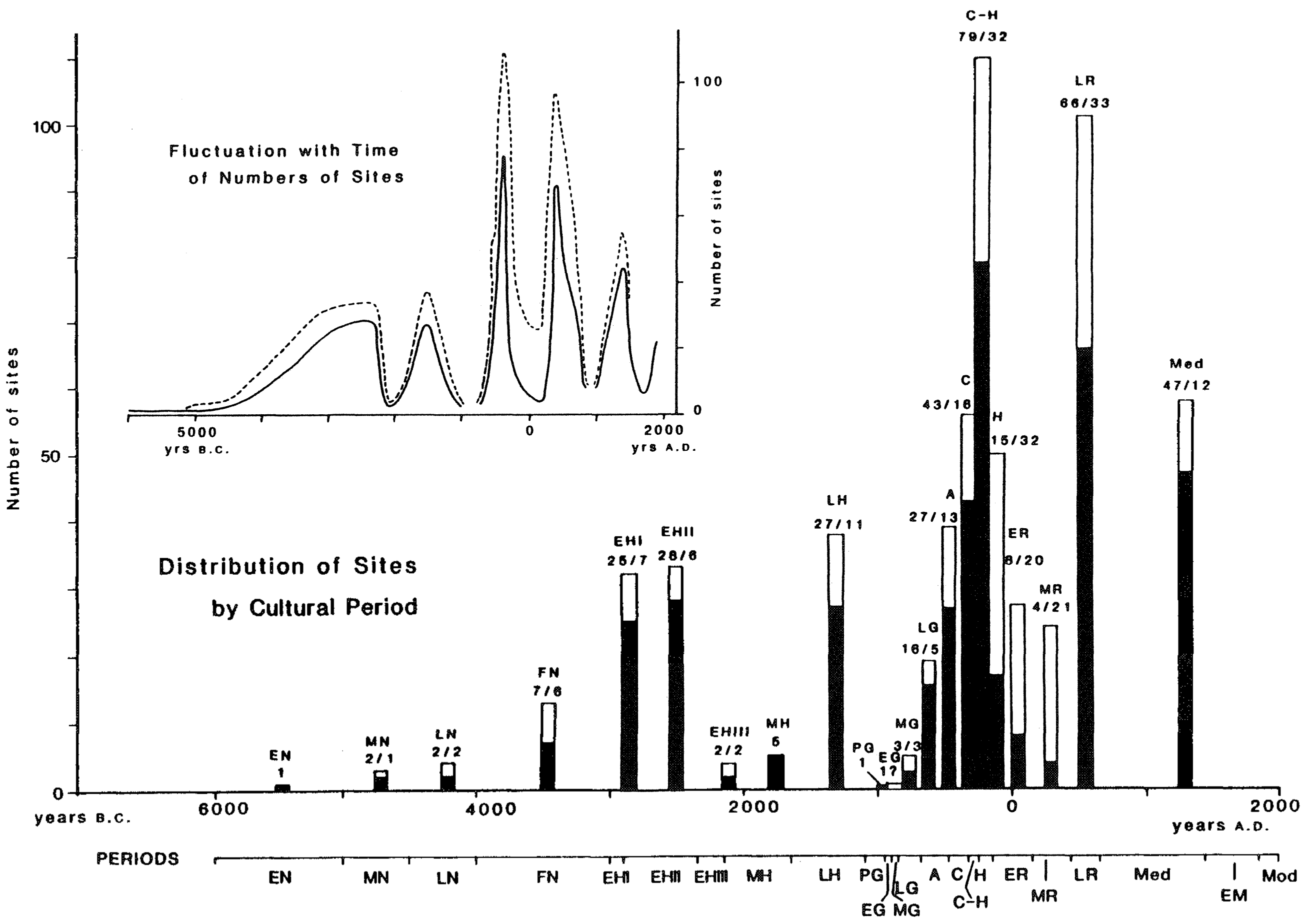


Figure 2.1 Site numbers from the Southern Argolid Survey. Dark shading represents confirmed sites, open bars represent possible sites (from Jameson et al., 1994).

other specialists such as we gathered here for our conference at Durham.

Can we provide other descriptive characteristics for these apparent cycles?

- Duration: frequently the oscillation is of the order of 4–500 years (Figure 2.1 shows oscillations of the medium-term on a large and small scale from the S.W. Argolid Survey project [Jameson et al., 1994]).
- Synchronicity: comparisons between different regions of the Mediterranean show that cycles are not only out of phase with each other but there may actually be negative correlations. One example that has become clear since the 1980's is the decline of Roman settlement density in much of Italy and the other Western provinces between the Early and Late Roman Imperial centuries and a corresponding rise in settlement density in the Eastern Roman Empire (Bintliff and Snodgrass, 1988a). Significantly within each country there are divergences from the general trend; some districts of Southern Italy (Gualtieri and de Polignac, 1991; Small, 1991) and some parts of Southern France (Trément, 1994) may remain unusually populous in the Late Empire, whilst isolated districts of the Eastern Empire may fail to respond to the general trend to population climax in the 4th-6th centuries AD (e.g. the territory of Haliartos in Boeotia [Bintliff, 1991a]; the district of Atene in Attica [Lohmann, 1993]).
- Manifestation in the archaeological landsurface: cyclical peaks of population tend to be associated with high rural and urban populations, largescale investment in monumentality and permanent technology (mills, villa walls, temples) and at least in some cases, intensive inputs of labour into the landscape (terracing,manuring). Figure 2.2 shows Tony Wilkinson's model for manuring horizons and population cycles (Wilkinson, 1989).
- Mike Fulford has argued (1987) that many of the well-known peaks of ceramic fineware export from particular regions in the Greco-Roman world are primarily a factor of agro-demographic-led, regional agricultural productivity booms in which ceramic containers *reflect* rather than *create* the export cycle, which is in turn based on enhanced surplus food production in the region. In this model, recognizable fineware exports are carried 'on the back' of bulk food export, amphora shipments; examples he cites

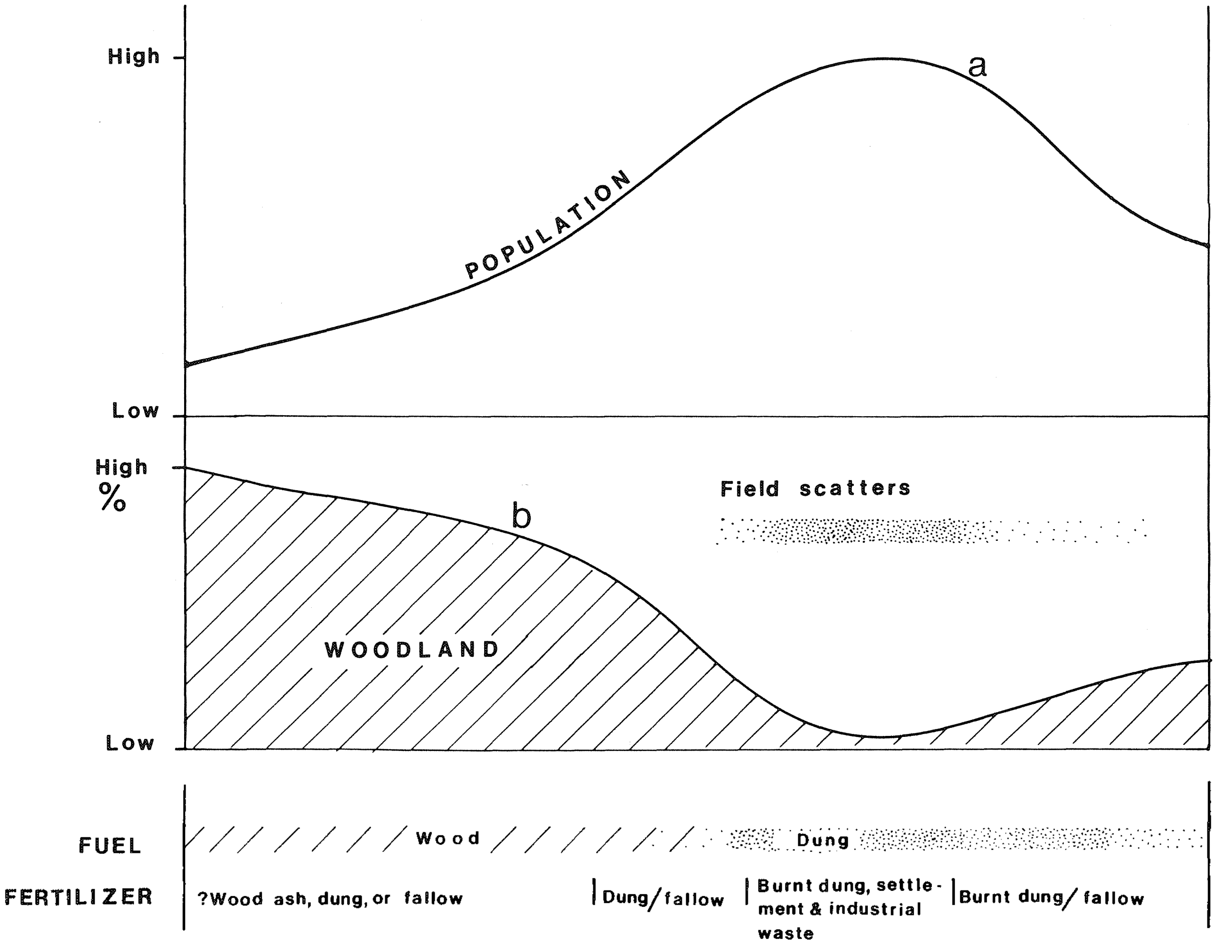


Figure 2.2. Model for the processual relationship between major agricultural manuring horizons and population growth, based on on-site and off-site survey evidence (Wilkinson, 1989).

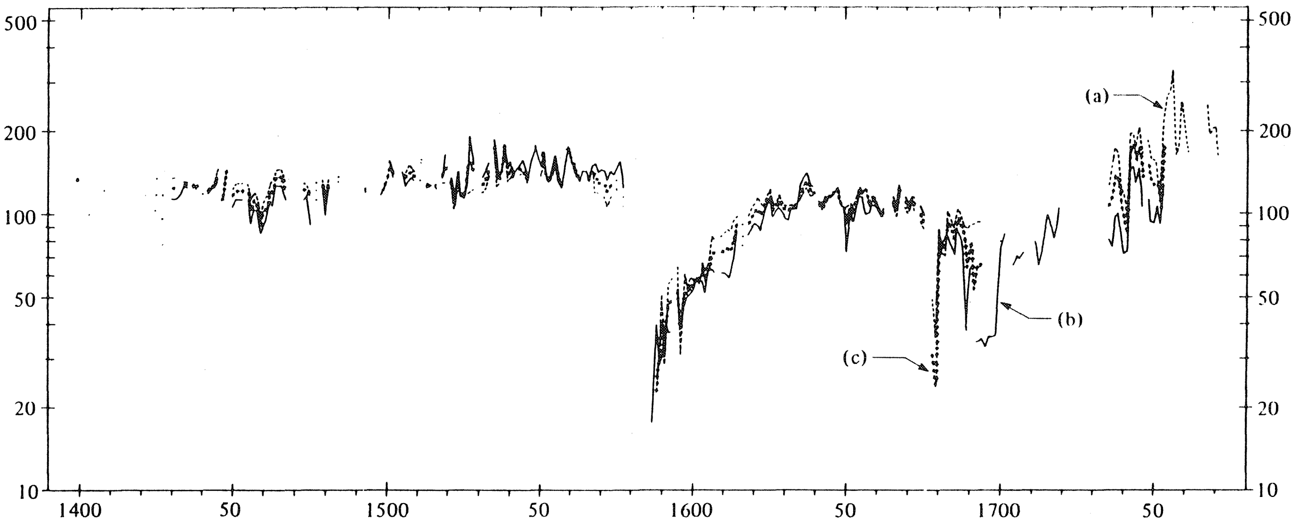


Figure 2.3. Fluctuations in grain tithe in south-western Brabant, 1400–1770 (from Ladurie and Goy, 1982, after Van der Wee).

are the wine/oil exports from North and Central Italy in the late Republic to early Imperial era, the rise of Iberian exports in the early Empire, the dominance of North African exports in the middle Empire, and the late flourishing of Eastern Empire exports in the period 400–600 AD.

REGIONAL CYCLES: EXPLANATORY VARIABLES

The French Annales' historian Le Roy Ladurie has helpfully discussed the complexity of economic and demographic cycles in the context of French rural history since the Medieval period (Ladurie and Goy, 1982; Figure 2.3 shows an example of agricultural productivity indices from that study being used to reflect regional economic cycles). He points to a Braudelian multilayered temporal packing of cycles, with our strong recurrent 4–500 era being at the far end of a spectrum of cycles extending from those of a few years via generational fluctuations. For each he discusses the pertinent factors that are known to be influential eg epidemic and endemic disease, climatic fluctuations, political and social instability.

In what follows I shall focus on the Braudelian 'medium-term' oscillations which are most often recognisable from survey data.

A general review of European settlement history in the later prehistoric period (Bintliff 1984, a, b) has shown that medium-term population cycles are a characteristic feature of all regional sequences both in Mediterranean and temperate Europe. Given the comparable evidence for Greco-Roman regional development (see above) and the growing suggestion that cycles may be negatively correlated from region to region, an obvious model to investigate might be Core-Periphery/World Systems theory; shifting economic foci and hence demographic concentrations, with associated zones of dependence, could explain the *out-of-phase* cycles observed in adjacent regions. An attractive example which might illustrate the migration of core regions would be the observation of Hodges and Whitehouse (1989) that the population epicentre in the Mediterranean shifted in the period 1st–9th centuries AD from Rome to Constantinople, then to Samarra, and finally Baghdad, with concomitant shifts in the level of urban and rural populations supporting the primate city in its immediate hinterlands (the heartlands of the Western Roman Empire, the Eastern Roman Empire and early Islamic Caliphate respectively).

In contrast, in *phase shifts* such as the general expansion of European populations between 800–1300 AD can more plausibly be associated with regional indigenous rather than interregional interactive growth of an eco-demographic character (cf. Bintliff and Hamerow, 1995).

One of the most significant achievements of that far more detailed understanding of regional settlement history which has been made possible through intensive survey, is that it allows us to make such interregional and intraregional comparisons (cf. Barker and Lloyd, 1991). Moreover, the growing interaction between survey archaeologists and ancient historians allows us to perceive the real complexity of the demographic processes at work. It has thus become quite clear that no single factor can be considered responsible for regional demographic growth, stability or decline – the only proper approach to the interpretation of a particular regional demographic trajectory has to be the use of multiple, complementary models.

I have recently used such a multiple-model approach to analyse regional demographic development trajectories in Greece between the early historic (Geometric-Archaic) period of the Early Iron Age and that of the Late Roman era[1]. That study began with a well-known historical observation and sought to investigate its significance for regional survey, and hopefully will serve to illustrate the value of complementary models in understanding regional population cycles as revealed by intensive surface survey.

DIVERGENT REGIONAL DEMOGRAPHIC TRAJECTORIES IN ANCIENT GREECE

The focus of ancient Greek politics and military power shifts from the South-East to the North and West from Classical to Hellenistic times (Figure 2.4). Is this historical accident or is there a deeper structural meaning? Familiarity with the broad lines of Greek geography (Figure 2.5) shows that the power-games of *later* Greek history are played in the more mountainous upland regions eg Macedonia, Epirus, Aetolia – giving priority to 'Lowland Peoples' in 'making history'. But how truly do political and military history reflect population changes, urbanism and economic development in the different regions of Greece? The best approach to test this is to use landscape archaeology – especially using the results of regional survey – where we can look at these phenomena in terms of the transformation of settlement patterns.

I have recently collated the information from intensive and extensive surveys as well as largescale excavations, for the different regions of Greece, for the period from the Early Iron Age to the Late Roman era. I want to focus on the period in which each region first achieved a great population density or even a population climax in town and country (Figure 2.6). Here are some examples of site frequency charts for several regions of ancient Greece: some such as *Corinth* and *Nemea* see population takeoff early, in Geometric to Archaic times; others such as *Methana* reach a rapid population climax in overall rural population and urban growth in Classical times; yet others such as *Achaea* see population takeoff in Hellenistic, Roman or even Late Roman times.

If we summarize the results for all the regions where adequate data are available (Figure 2.7), we can say the following about the archaeological evidence for demographic development:

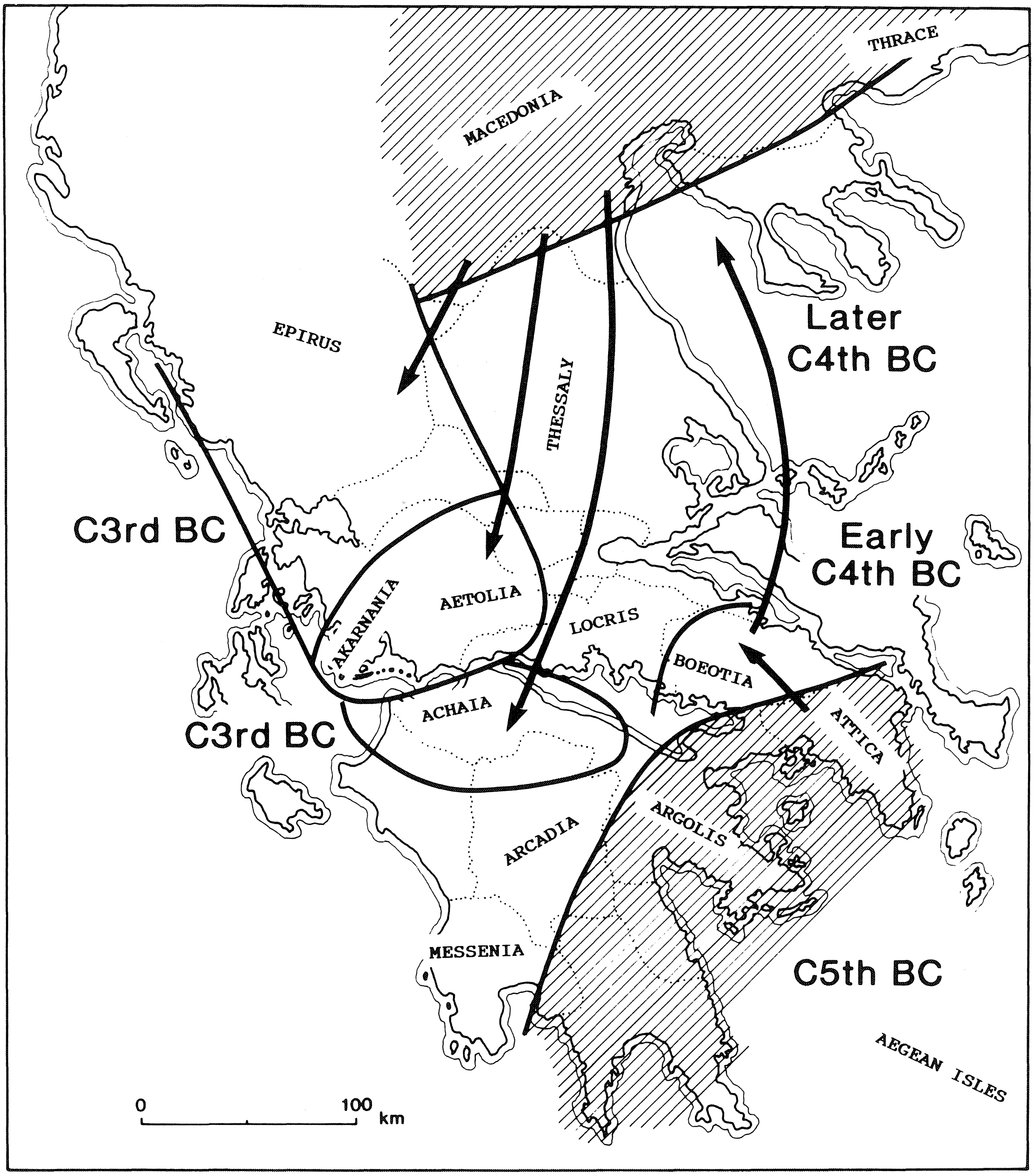


Figure 2.4. Power shifts in the location of dominant states in ancient Greece. Boundaries shown are the major regions of ancient Greece.

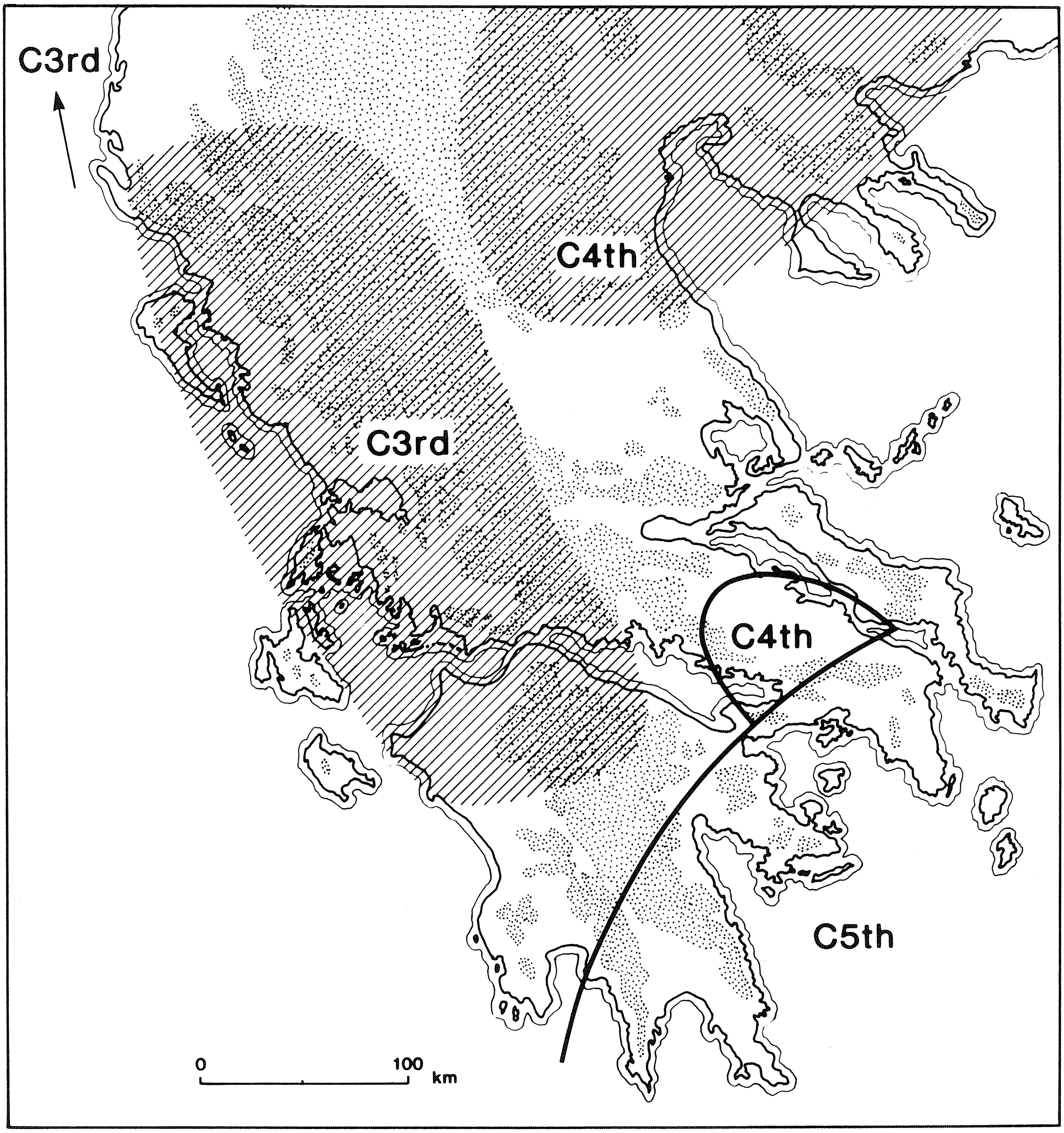


Figure 2.5. Power shifts in ancient Greece with land above 500m.

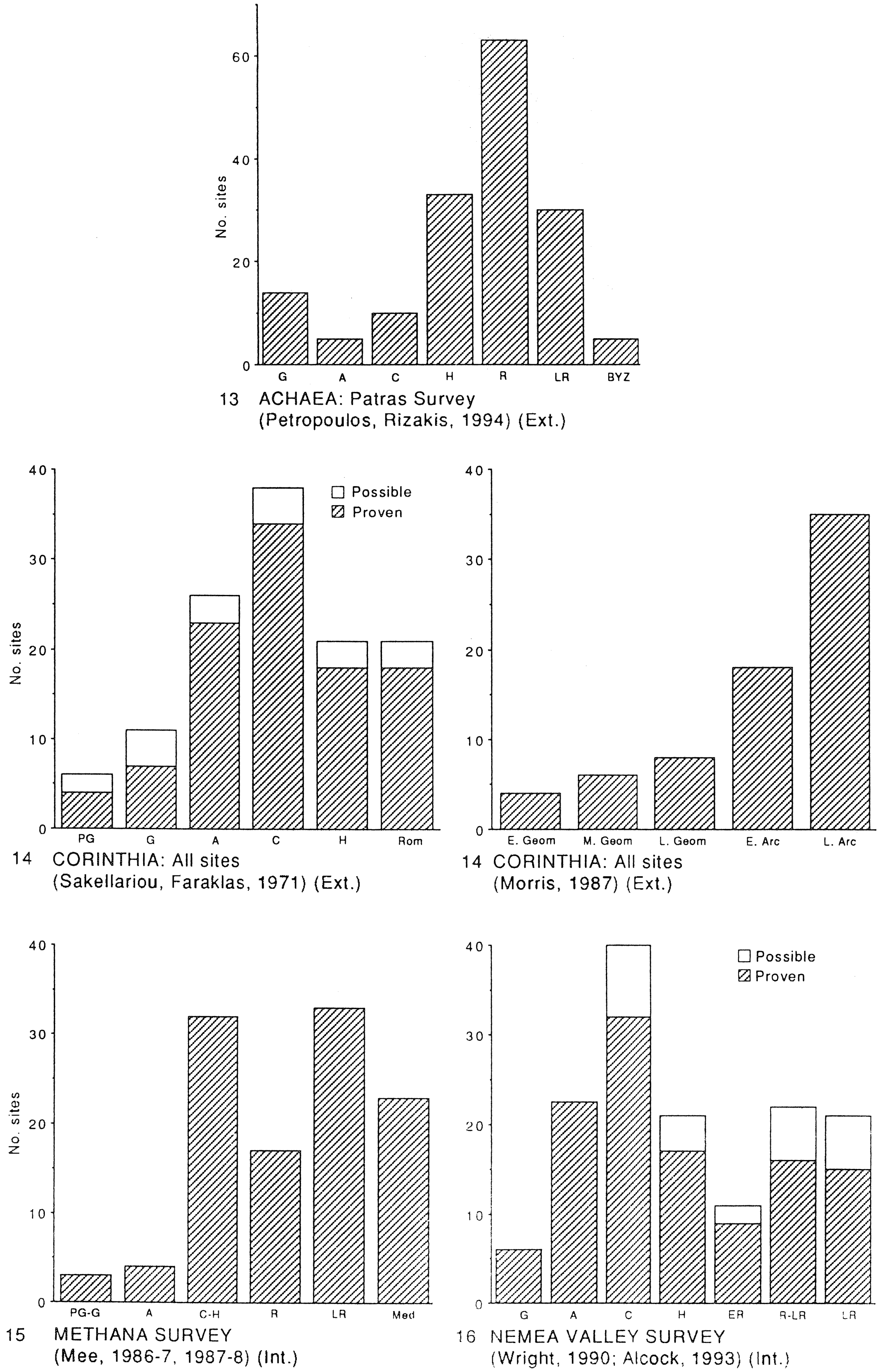


Figure 2.6. A selection of site frequency charts for several regions of the Peloponnese, southern Mainland Greece, derived from intensive (Int.) and extensive (Ext.) survey.

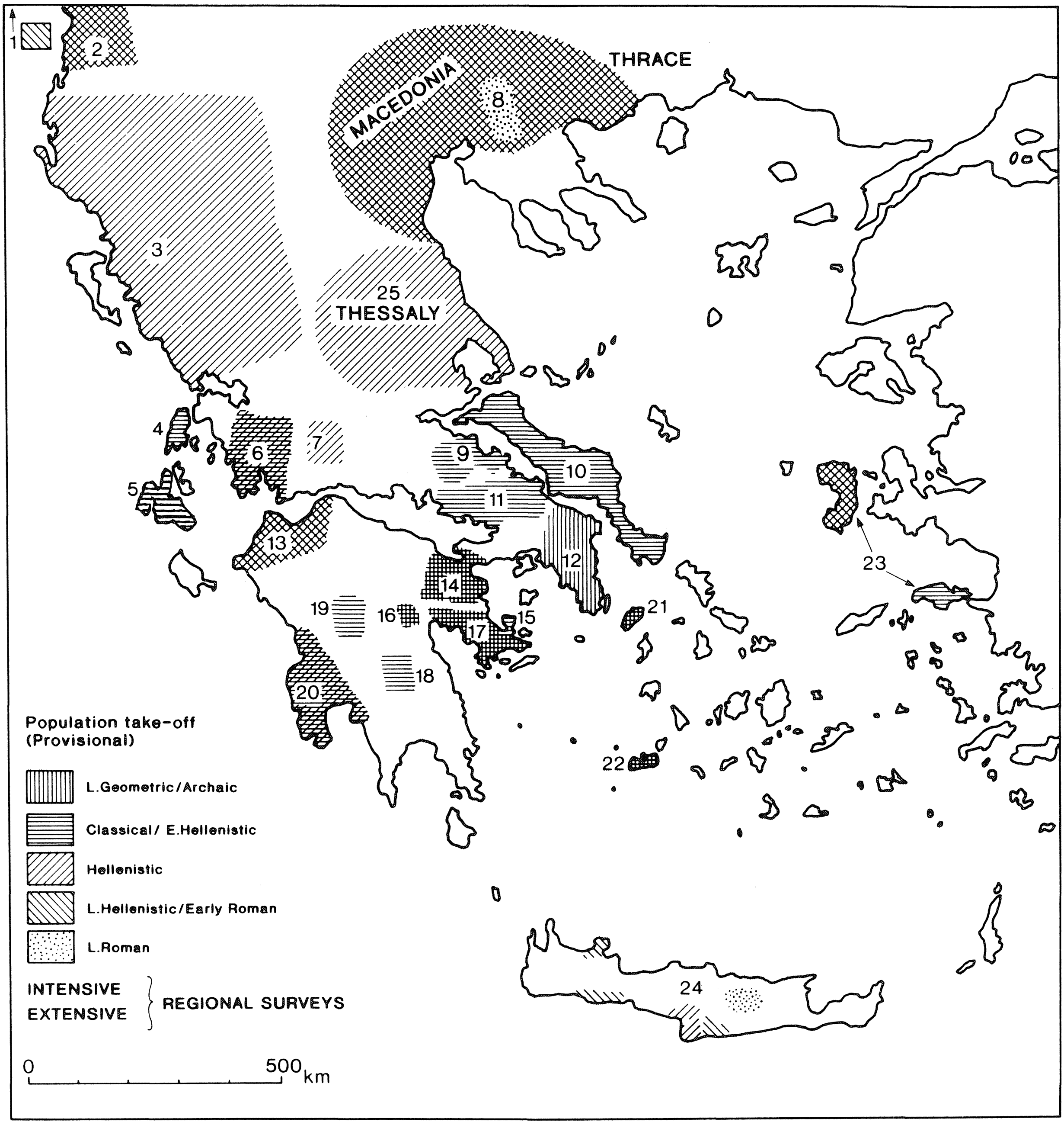


Figure 2.7. The distribution of primary population climax phases after the Bronze Age and before the end of Late Roman times in Greece, based on the evidence of intensive/ extensive archaeological field surveys and regional settlement history syntheses.

1=Dalmatia. 2=Albania. 3=Epiros. 4=Levkas. 5=Kephallenia. 6=Akarnania. 7=Aetolia. 8=Macedonia. 9=Phocis-Lokris. 10=Euboea. 11=Boeotia. 12=Attica. 13=Achaea. 14=Corinthia. 15=Methana. 16=Nemea. 17=Argolid. 18=Laconia. 19=Arcadia. 20=Messenia. 21=Kea. 22=Melos. 23=Samos-Chios. 24=Crete. 25=Thessaly.

- Early growth in Athens and adjacent lowlands, Geometric to Archaic
- Central Greece and the wider Peloponnese follow, in Classical to Early Hellenistic times
- A Hellenistic takeoff occurs in Western Greece and Macedonia, more upland areas
- An Early Roman climax is seen in the Eastern Adriatic and on Crete as a whole
- For the most marginal areas eg upland Crete and inland Macedonia, population climax may be Late Roman.

This scenario fits political history very well:

- An early historic dominance of Athens, Corinth, Argos
- The later rise of Boeotia

1. Region ↔ Macroregion Model
2. Braudelian 'Annaliste' Structural History Model
3. Historical Accident, 'Events' Model
4. Core–Periphery, World-Systems Theory
5. Neo-Malthusian, Eco-Demographic Models (Kirsten–Renfrew–McNeill)
6. Combination Trajectory Models
7. The Socio-Structural, Punctuated-Equilibrium Model
8. 'Boom–Bust' Cyclical Evolution–Devolution Models; Upland 'Open–Closed' Models; Lowland 'Ecological Crises'

Figure 2.8. Interpretative models for regional settlement dynamics in ancient Greece.

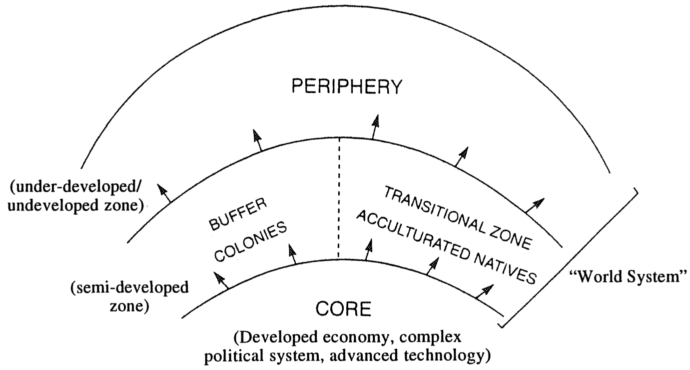
Region ↔ Macroregion Model

In evaluating regional trajectories, focus on:
1) Local Agricultural–Demographic Cycles;
   Local Human Ecology – 'Health'
2) Mode(s) of Production Operated at Local Level
3) Mode(s) of Production Operated at Macroregion Level
   (eg. by the State or other inter-regional socioeconomic systems)

Figure 2.9. A model for relating regional trajectory to enclosing macroregions.

HISTORY OF EVENTS	**Short Term – Événements** Narrative, Political History; Events; Individuals.
STRUCTURAL HISTORY	**Medium Term – Conjonctures** Social, Economic History; Economic, Agrarian, Demographic Cycles; History of eras, regions, societies; Worldviews, ideologies (*Mentalités*).
	Long Term – Structures of the 'Longue Durée' Geohistory: 'enabling and constraining'; History of civilizations, peoples; Stable technologies, world views (*Mentalités*).

Figure 2.10. Braudel's model of hisotrical time.



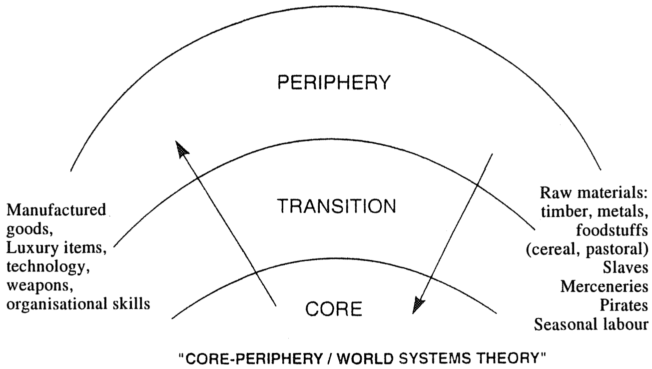


Figure 2.11. "Core-Periphery / World Systems Theory".

- The much later rise of Macedonia, Epirus, Aetolia, Achaea, and the Illyrian powers
- Crete a general backwater.

What interpretative models help us analyze these patterns? We need a range of complementary approaches to cope with the complex structure revealed (Figure 2.8). In this summary of a much longer study I shall merely make a few comments about the value of each of these models for understanding the divergent regional developments in ancient Greece.

Let me start with two general models to clarify our overall approach to regions. The *Region Model* (Figure 2.9 [cf. Bintliff and Snodgrass, 1988a; derived from the ideas of Chris Wickham]) states that for any region we have to look at its own 'health', – its longer-term history of land use and human ecological balance, as well as its mode of production, before considering its interactions with other regions. *Structural History* or the *Braudelian Model* (Figure 2.10 [cf. Bintliff, 1991b]): regional histories are the product of processes operating at different time-levels: the short-term, political events mode; the medium-term cycles (see above), of growth and decline, *or* of 'motionless history' with little change (Ladurie, 1974); the long-term waves of a millennium or more in which major innovations in technology, economy or social organisation create cumulative effects on a region.

Now moving to more specific models. The *Core-Periphery* or *World Systems* model (Figure 2.11) focusses on the usually exploitative interactions of an economic kind between 'core regions' with advanced economies, technology and political structures, and less developed regions. Applying this model to ancient Greece (Figure 2.12) proves illuminating – with the economic and military influence of precociously-powerful South-East Lowland states diffusing outward over time to less developed peripheral regions. Relevant too is a corollary of the model, that in time peripheries can be stimulated to become cores themselves and grow to dominate former core regions.

Yet the last-named model offers incomplete explanations; some regions, e.g. Achaea, Crete, fail to develop

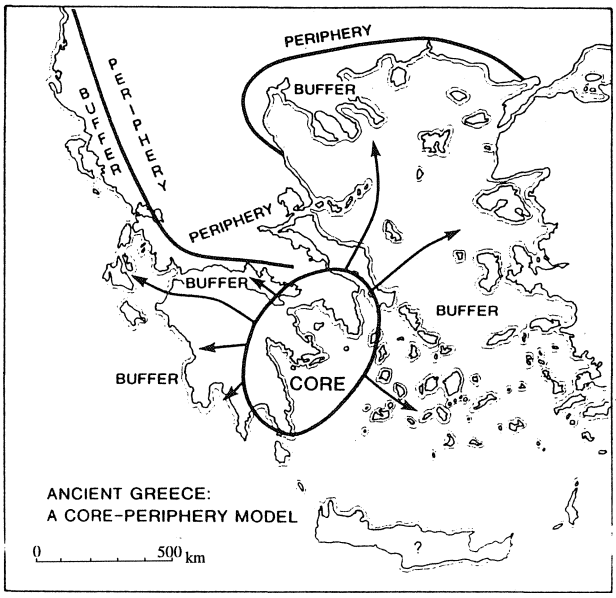


Figure 2.12. Ancient Greece: A Core-Periphery Model.

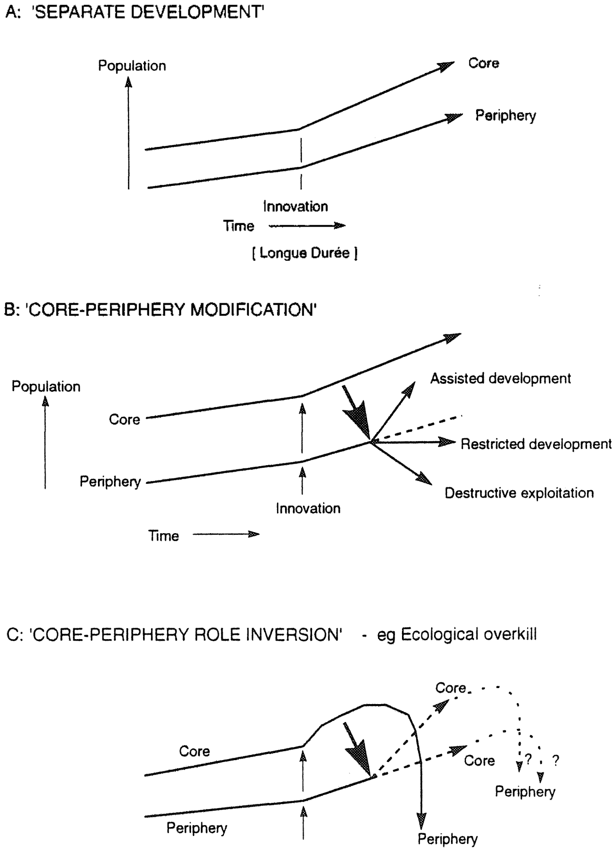


Figure 2.14. Regional Development Models.

despite favourable access to the core; others e.g. Boeotia and Thessaly, reach climax development without any clear external stimulus to their essentially internal economic development.

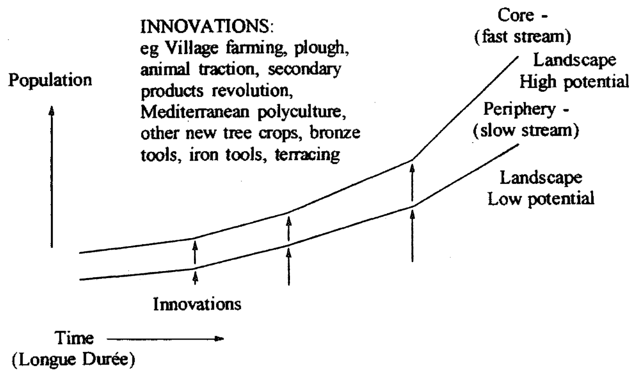


Figure 2.13. Braudel/Malthus Longue Durée Model.

The *Eco-Demographic* or *Neo-Malthusian* model (Figure 2.13): a number of Aegean specialists in both the Bronze Age and ancient to medieval history, have used ecological and geographic factors to interpret the uneven regional development patterns within Greece: the rise of Minoan and Mycenaean civilisations, and that of the South-East Lowland Classical states have been associated with Mediterranean polyculture and excellent maritime communications; to these positive incentives to economic and demographic growth other scholars add a negative factor – stress and risk in the Lowland South-East Aegean – which may have stimulated more complex development in this arid region with unpredictable crop production.

The model I show here combines this 'regional geographic inequality' with long-term stimuli to increased production affecting *every* region of Greece: the cumulative effect of innovations such as ploughs, animal traction, the Secondary Products' revolution (Sherratt, 1981), bronze and iron technology: over millennia, all regions may grow in population and economic productivity, but local geographic potential will create increasing divergence in growth rates. Eco-demography also suggests that regions may undergo cyclical collapse due to over-cultivation and erosion – as has been argued for Lowland Greece in several eras.

Once again, although this model gives further helpful insights into the observed patterns of regional development in ancient Greece, – especially the recurrent focus on the South-East Lowlands, and the retarded growth of Arcadia, Achaea and North-West Greece, – there are regions which don't fit the model, e.g. Messenia, and Crete again.

The next model (Figure 2.14) combines the effects of *Core-Periphery* and *Eco-Demographic* models: as regions diverge due to the varying effects of widespread innovations and natural geographic potential, interactions come into play between precociously-populous and powerful regions and those less developed: these economic and military interactions can produce varying effects: stimulating growth in the periphery, arresting it into 'underdevelopment', or deconstructing peripheral growth into collapse.

I would argue that left to themselves – apart from the general diffusion of technical innovations, all but the least

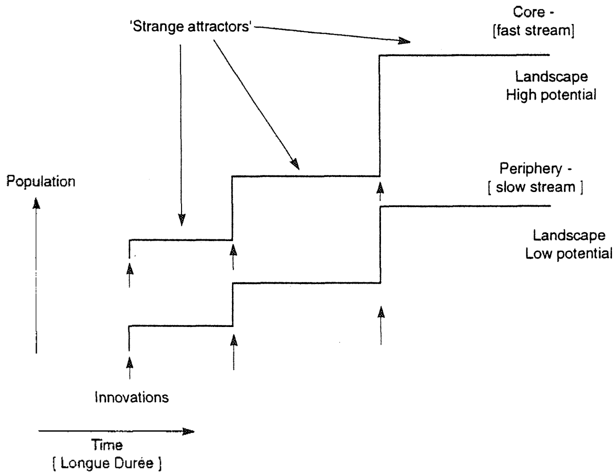


Figure 2.15. The Punctuated-Equilibrium or Strange Attractor Model for regional development, fast and slow stream variants.

Mode 1: 'Closed'	Mode 2: 'Open'
1. Low birthrate Late marriage	1. High birthrate Early marriage
2. High celibacy	2. High marriage rate
3. Low populations Low emigration	3. High populations High emigration
4. External connections low	4. External connections high
5. Economics mainly internal, independent	5. Economics dependent on external income

Figure 2.16. An Oscillatory Model for the Historical Demography of High Upland/Marginal regions (After Thomas Malthus, 1803, An Essay on the Principle of Population; and P. P. Viazzo, 1989, Upland Communities).

geographically-favoured regions of Greece would have developed towards more complex forms of society and higher productivity with urbanism: unequal growth led however to destabilizing interactions between core and periphery and that hastened or delayed that process.

The *Punctuated Equilibrium* or *Strange Attractor* model (Figure 2.15): I have introduced this model to account for some anomalous regional developments, where the reception of innovations to a region initially pushes its growth to a new level – but then this is followed by stabilisation or stagnation well below regional potential. Two cases may be mentioned: firstly Eastern Macedonia, where village networks seem to dominate till Late Roman times, and Crete. For the latter, it can be argued that a conservative sociopolitical system froze demographic and economic development throughout the Classical Greek period. I consider that Eldredge and Gould's (1972) 'Punctuated Equilibrium' model and that of 'Strange Attractors' drawn from Chaos-Complexity theory (Lewin, 1993) may be suitable ways of conceptualizing what Ladurie has called periods of 'motionless history' (Ladurie, 1974; cf. Bouwsma, 1979).

A final model is required to account for regional patterns which defy all the preceding explanations: some regions of Greece are so poor in natural resources that their periodic population climaxes and associated short-lived politico-military influence in Greece seem to challenge understanding. Two clear examples are rugged, mountainous *Epirus* and *Aetolia* in North-West and North-Central Greece respectively – unexpectedly powerful and populous in later Hellenistic times. They are typical though for other mountainous regions of Europe, in showing short-lived 'boom-bust' phenomena in population and economic growth. Paolo Viazzo's (Figure 2.16) *Mountain Society* model, based on Malthus' own observations of the phenomenon, proposes two modes for mountain society demography (Viazzo, 1989):

- A normal 'closed' system with low population matched to poor regional economic potential
- An abnormal 'open' system when mountain peoples become very populous via parasitism on wealthier lowland regions through out-migration, seasonal labour, mercenary service, raiding or other forms of oppressive exploitation.

In effect the short-lived population bursts of Hellenistic Epirus and Aetolia conform well to the model, as does the relative obscurity of these regions in history ever since.

SUMMARY

We need many complementary models: A regionalist perspective is essential to account for the particular trajectory of each region of ancient Greece; this confirms the importance of local geography for regional development and the lack in pre-Capitalist times of effective economic integration between regions. Nonetheless, the diffusion of innovations, and core-periphery interactions have a profound influence on the timing and intensity of regional growth patterns; all this supports the concept of geographical '*Possibilism*' advocated by Vidal de la Blache and Febvre (landscapes 'enabling and constraining' regional developments; cf. Bintliff, 1991b; Holt-Jensen, 1988: 33ff.). Finally, sociocultural effects can insulate local societies from both local geographic influence and external stimuli – creating Ladurie's '*Motionless History*'.

NOTES

1. The full version of this study of regional survey and demographic history in ancient Greece has appeared in the *Journal of Field Archaeology* in 1997.

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3. Counting People in an Artefact-Poor Landscape: The Langadas Case, Macedonia, Greece

Stelios Andreou and Kostas Kotsakis

Archaeological work in Greece has taken a major turn during the last fifteen years towards regional studies which are based primarily on the intensive and systematic survey of the countryside. With few exceptions, the new wave of archaeological investigation has followed on the tracks of previous work focussing on the areas of the southern Mainland and the Islands and complementing the long tradition of archaeological and historical research there. Consequently, surveys can draw on a vast archaeological and historical data base ranging from excavated sites to the accounts of 19th century travellers and ethnographic studies.

The numerous recent projects have made major contributions to the clarification of regional historical trajectories through the understanding of the variations in settlement and land use patterns in different areas of the South. Despite chronological and geographical variations, a common element in most of these areas is an impressively rich and diverse material record of the past preserved on the ground. This record implies, at least for some periods, a densely occupied and intensively used landscape (Bintliff and Snodgrass, 1985; Cherry *et al.*, 1988).

In the northern part of the country the situation appears to be different in many respects. Intensive archaeological work for all periods is a matter of the last two decades, and the existing body of written sources, particularly for the period prior to the Byzantine era, are still little exploited or exhibit serious gaps. In fact it is debatable whether the paucity of archaeological and historical evidence reflects simply the longer research tradition of the South, or real differences in the scale and content of social and cultural reality between the two areas. It may only be in the Hellenistic and Roman periods that the area becomes firmly integrated with the rest of Greece. It has been proposed that the local traditions of the earlier historical period in Central Macedonia, which has come recently under closer archaeological investigation, go as far back as the Neolithic and the Bronze Age (Andreou and Kotsakis, 1994).

More than twenty years ago Colin Renfrew argued, on the basis of the existing information from non systematic reconnaissance, that there were already perceptible demographic differences between northern and southern Greece during the prehistoric period. According to this early discussion the lower density of population in Macedonia is a clear mark of an important divergence after the end of the Neolithic period related to the lack of socio-political complexity in the area (Renfrew, 1972: 226–54). Turning now to the historical period, up to the 4th century BC, the absence of the political formation of the city-state in the area – with the obvious exception of the coastal towns and the southern Greek colonies – as well as of any major urban centres (Papazoglou, 1988: 37–51), could again be related to lower population densities and human interaction with the landscape. It could also be related to a rural economy of a different scale and a less intensive organisation of the rural landscape around and between the small towns and villages of the area (Alcock, 1994: 179). Consequently, the low density of occupation and use of the landscape comes up as a recurrent element of Greek Macedonia in the past. A regional survey offers an opportunity to test the assumptions about the demographic situation in northern Greece in comparison to the results of similar investigations in the South. At the same time one could test the comparability of data originating from projects in areas with possibly different historical trajectories, research histories and environmental conditions.

The Langadas survey was initiated with the aim of investigating an area in northern Greece characterised by the dearth of information on human activity in the past (Kotsakis, 1989; Kotsakis, 1990; Kotsakis and Andreou, 1992). A comparison of the data from this survey with those from southern Greece offers an opportunity to test the proposed demographic differences between the two areas. The area is a well bounded inland basin, located 30 kilometres away from the coast (Figure 3.1). At present two lakes occupy the bottom of the basin and a limited number of passes through the surrounding mountains and hills lead to the adjacent valleys and to the coast. In the

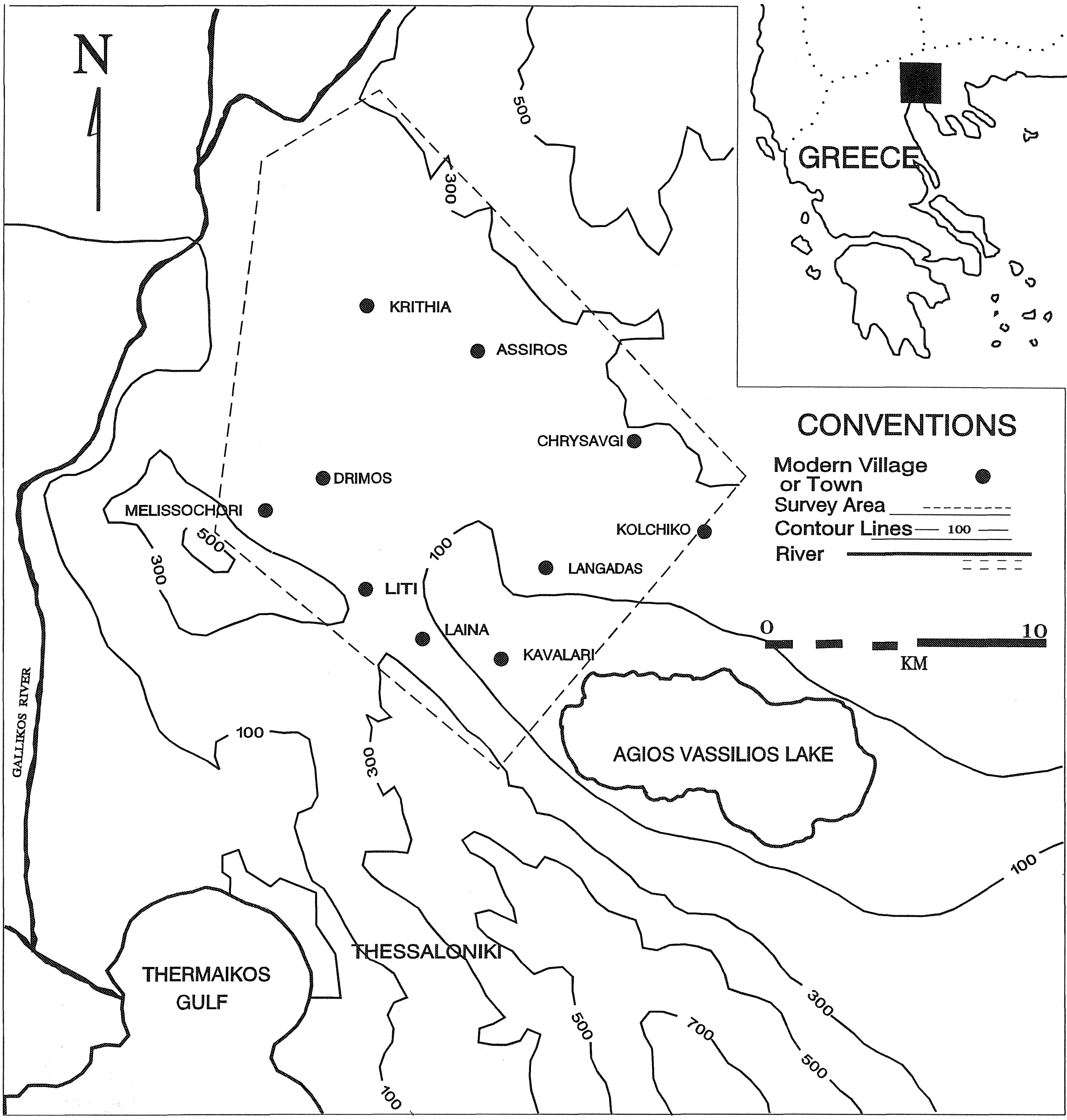

Figure 3.1. Langadas Survey area.

target area of approximately 200 sq. kms in the western part of the basin, the extensive excavations at Assiros Toumba have offered valuable information for the later part of the second and the early centuries of the first millennium BC, but apart from that little else is securely known about the history of human habitation in the area. The town of Lete has gained some prominence in research, predominantly in relation to the chance find of significant inscriptions describing details of its political and religious structure during the late fourth century. Considerably more archival – but still very little archaeological – information is available for the Byzantine and Ottoman periods, which we shall not deal with extensively here. Urban settlements of the Classical to Roman periods, such as Apollonia and Kalindoia, are also reported from the eastern part of the basin, which is presently outside the target area of the survey project.

The project in four monthly seasons has studied intensively 30% of the target area, and has taken a sample of the different environmental zones, with the exception of the bottom of the basin where archaeological and geomorphologic work has indicated the existence of a fairly recent alluvium (Figure 3.2). The recent alluvium limits discussion to the surrounding higher level zones.

The method of survey follows the same general lines as the examples from southern Greece, with people walking

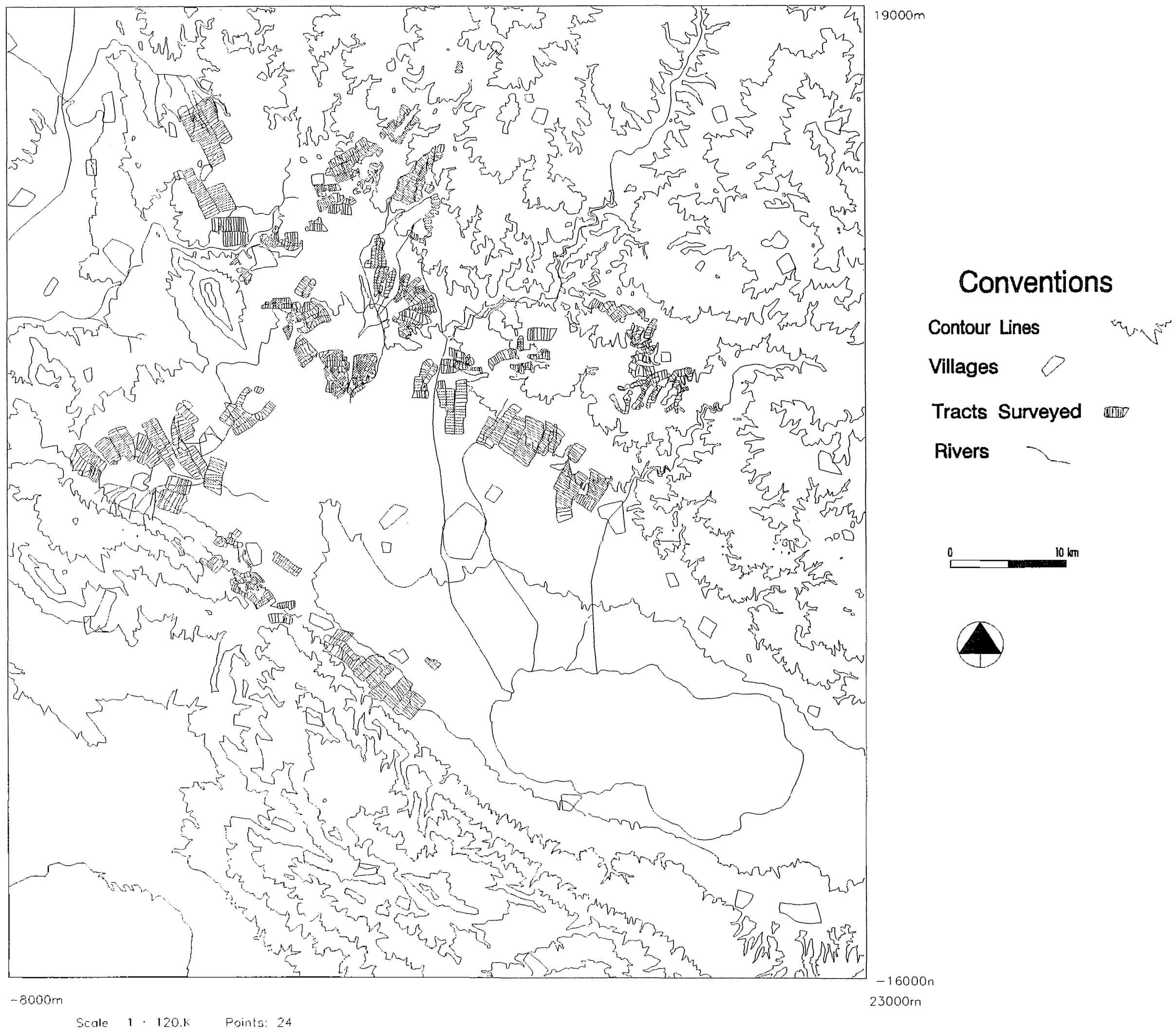

Figure 3.2. The Langadas Survey area with tracts surveyed (1987–92).

in regular intervals of approximately 20 m counting sherds and other material over parallel, 100 m. long, transects (cf. Cherry *et al.*, 1991: 22–28; Jameson *et al.*, 1994: 219–21). The main difference, however, is that the counting of finds does not follow the field by field walking technique but is done instead irrespective of fields, in regular 100 m transects. Thus, the parts of the Langadas countryside that have been walked are covered by grids of a 100 x 20 m. which can be easily related to topographical features and which contain sherd and other artifact counts. This allows the direct comparison of results between transects. Visibility and other physiographical features are regularly documented for each transect, or even for parts of a transect, if need be.

Artifact densities have proven useful indicators of the scale of human occupation and the intensity of land use in southern surveys. It would be worthwhile therefore to examine the Langadas data in this respect. There are however, some methodological points worth discussing here. As far as one can tell from published accounts, densities in surveys of southern Greece are calculated as sherd frequencies by area of individual fields (but see Bintliff and Snodgrass, 1985 for a similar approach to Langadas). By contrast the technique used at Langadas is not dependent on field size, actually measuring frequencies in regular intervals of 0.2 ha. We may assume that the two measurements are not exactly comparable and that the Langadas system is less sensitive to sites that are somehow related to the size and shape of fields. It should be pointed out, however, that large parts of the survey were walked through on even terrain with fields that were, as a rule, of roughly similar shape and size. This regular field pattern is a result of the recent land redistribution related to the settlement of Greek refugees from Anatolia after 1922. The old network of fields was therefore destroyed and survived only in rare instances around the old villages, not settled by the refugees. A considerable part of the area walked has only recently been given to cultivation, whilst another portion in higher ground remains uncultivated continuous pasture-land.

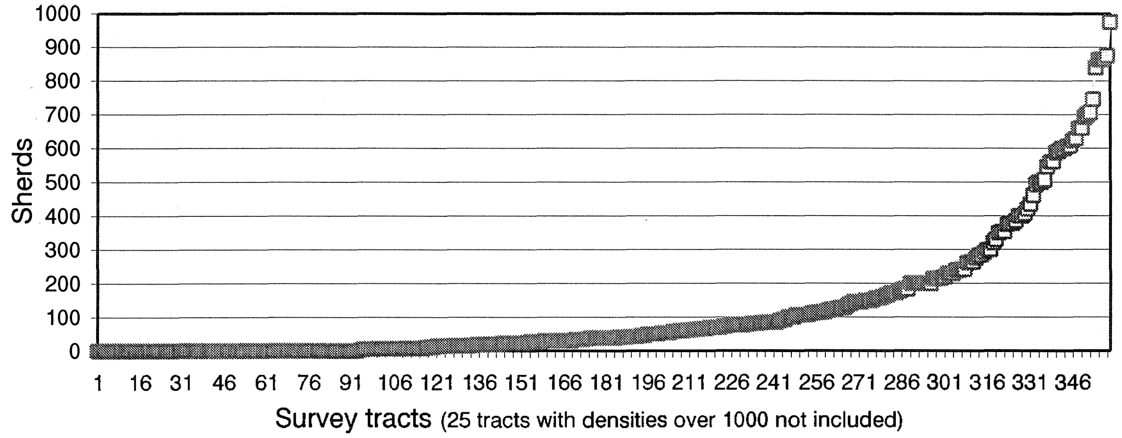

Figure 3.3. Mean density of sherds per ha.

On the other hand, the uniform grid applied at Langadas will tend to produce more counts in a given area than for example the survey of Nemea, as long as the mean size of fields in the latter is according to Alcock *et al.* between 1 to 2 ha (1994: 138). The mean densities of course, that is the pooled densities of extended stretches of land, will be easier to compare, although this sacrifices the fine resolution of the Langadas grid. In brief, it appears that a necessary step before any conclusion can be made is the detailed reporting of the calculations of density, as well as of the actual frequencies of artifacts.

With these reservations in mind we will examine briefly whether we could base our first conclusions about density of occupation and land-use on sherd frequencies, and more specifically on the actual number of zero counts in 100 m transects, in other words on the large areas with no traces of human activity observed in the Langadas basin. Out of a total of 16,765 linear transects walked up to 1992, 9576 have zero counts, which represents 57.1% of the total. Another 1655 linear transects, 9.9%, have only 1 sherd. In total 79.3% of the 100m transects walked have counts of less than 5 sherds. If one accepts , as we do, that each fieldwalker scans a linear transect of 1 m. width this would amount to a maximum of 4 sherds per 100 sq. m. walked. If however, a 2 m width of scanning would be assumed (Cherry *et al.*, 1991: 53; Alcock *et al.*, 1994: table 8.2) the outcome would be a density of 2 sherds per 100 sq. m.. With a 5 metre wide scanning zone the density would be calculated to 0.8 sherds per 100 sq. m. (Bintliff and Snodgrass, 1988: 506). This is a potential source of variability which makes interregional generalisations and comparisons difficult.

Nevertheless, even if transects with low frequency are excluded, the remaining large amount of zero counts is potentially significant for the reconstruction of the pattern of land use and settlement in the area of Langadas. Compared to the available evidence from some projects in southern Greece it is an indication that large parts of the Langadas landscape are devoid of any traces of human activity (cf. Cherry *et al.*, 1988: 160–61). These include areas with very high visibility which do not show traces of heavy erosion or alluviation and on which confined concentrations of finds of specific dates, designated as sites, have been located.

Given the presumed tendency of the Langadas system to produce more measurements and hence more zero measurements, it might be worth examining the densities in larger areas rather than in single 100 m transects. For this purpose the frequencies of sherds averaged over areas of 1 ha were calculated. The results are shown in Figure 3.3[1]. They represent a sample of an area of approximately 12 sq. km. spread over different geographical zones. The overall mean density of tracts is 315 (157.63) sherds /ha. An examination shows however, that 24% of the area exhibits zero densities per ha, while 65% of the total has densities under 100 sherds per ha, that is, less than 1 sherd in 100 sq m. Consequently the original observation concerning the generally low densities of finds and the existence of large segments devoid of any traces of past human activity seems to be confirmed. With the methodological reservations expressed previously, this suggests that overall human activity in the Langadas area was spatially discontinuous and focussed on specific locations, and that occupation and land use were accordingly of low intensity. While this picture may contrast strongly with the picture of some areas of southern Greece such as Boeotia, the contrast seems to be less marked when the Langadas data are compared with those from other southern regions such as Nemea or the southern Argolid (Alcock *et al.*, 1994: 138–41). Nevertheless this generalisation is too broad and needs to be assessed in relation to settlement and land use patterns. Furthermore, a closer control of the time factor and the chronological trends is also required. The assessment of time scales, through the dating of pottery at Langadas presents some difficulties. The low intensity of archaeological research in northern Greece, along with the very slow rates of change in the regional styles of pottery, make the resolution of dating

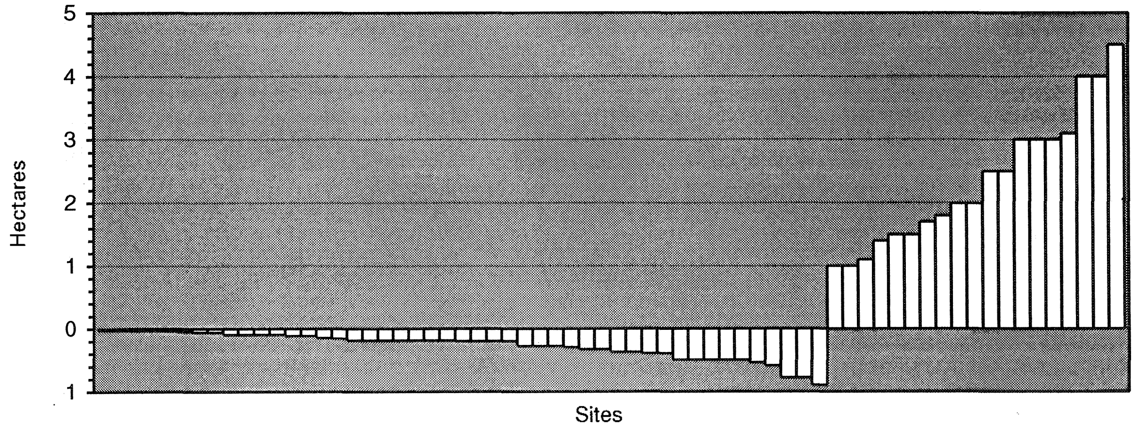

Figure 3.4. Size of sites below and over 1 ha (Sites over 5 ha omitted).

very low and broad for most periods. Often, the absence of closely datable sherds, usually of southern Greek wares, may only represent differential access to certain types of pottery instead of differences in date between specific scatters. Obviously this shortcoming affects both the spatial definition of the various chronological components of sherd scatters, as well as the identification of short term fluctuations in settlement patterns.

Let us now examine what a site means in the context of Langadas. In practice, all scatters defined initially as "sites of interest" have frequencies of above 7 sherds per 100 sq. metres. The density figure is very near the mean density of all transects below which 83% of the cases are clustered. That leaves 17% of the ground covered as probable area of "sites of interest", for further examination and systematic sampling. In reality, the size of the areas of interest was reduced considerably following detailed examination. The decision on the function of the observed concentration of artifacts was primarily based on qualitative criteria and included aspects of morphology, architectural features present on the surface, presence of anthropogenic deposits etc. The significance of the qualitative criteria cannot be overemphasised: in some cases, despite extremely high sherd densities suggesting occupation, no other features of similar significance were present. In one case, a density as high as 8500 (4250, 1700) sherds per ha, was shown, under closer inspection, to represent an off-site sherd scatter related to activities originating in a neighbouring settlement. It has to be stressed that this figure is among the highest at Langadas for all periods. It is not therefore a simple matter to define the function of sherd scatters solely on the basis of quantitative criteria. It has been rightly suggested that in order to decide the presence of a site, off-site and on-site densities of the same period should be compared (Cherry *et al.*, 1991: 19). This is generally true, but, as our experience at Langadas has shown, even comparisons of contemporary features can be very misleading. Therefore, the reliance on standardised thresholds even within the same region and for the same period may be far from safe (cf. Alcock *et al.*, 1994: 159). On the other hand if the more or less consistent density threshold of 30 to 50 sherds per 100 sq. m. used to define sites in the southern projects was to be applied to Langadas, a significant part of the generally small number of sites in the area would have to be dismissed (Cherry *et al.*, 1991: 46–47). In fact on-site densities in the 12 sq. km sample at Langadas range from 1–83 sherds per 100 sq. m. with a mean density of 10.87 per 100 sq m., while off-site densities range between 0–88 sherds per 100 sq. m. with a mean density of 1.2 per 100 sq. m.

At the moment some 86 confined locations with relatively high densities of finds of different periods have been identified as sites of some sort of repetitive human activity. Several of these sites have finds representing activities in more than one chronological period, ranging from 5500 BC to the 19th century AD. Considering that the area walked is c. 60 sq. km., a site density of 1.4 sites /sq km in Langadas rates remarkably low compared to that in areas of southern Greece. The Boeotia survey for example, has reported as many as 81 sites in an area of 21 sq. km, while the Kea survey has identified 71 sites of different periods in an area of 18 sq. km., both offering a density of c. 4 sites /sq. km. (Bintliff and Snodgrass, 1985; Cherry *et al.*, 1991).

Leaving aside for the moment the question of the function of these sites, we will attempt to discuss further their size. At Langadas the size of on-site sherd scatters varies from 0.03 to 70 ha, the more extended ones usually related to pottery dated to the post-Roman periods and particularly to the Ottoman period. The lower range, below 1 ha, represents 47 sites of all periods with the exception of the Neolithic, 54.6% of the total (Figures 3.4 – 3.6). The figure is a good indication of the intensity of the survey and combined with the observation made previously about large stretches of very low or zero frequencies of finds, suggests a low intensity of human activity in the area. Incidentally, the large number of very small sites, some of which are barely 20 m in diameter, answers the reservations expressed about the

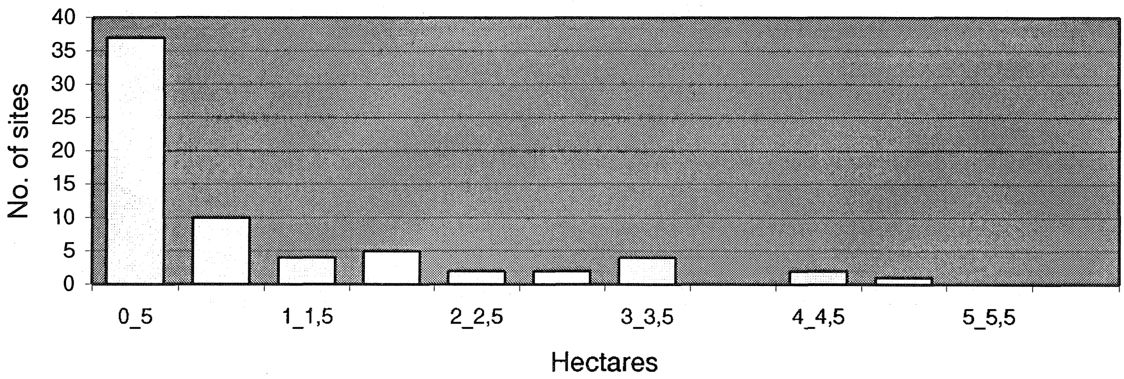

Figure 3.5. Distribution of sizes of sites in ha (sites below 6 ha).

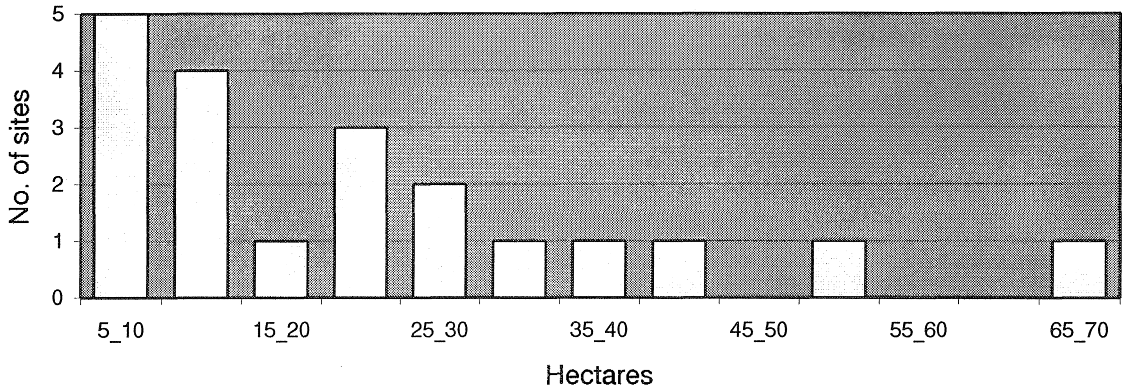

Figure 3.6. Distribution of sizes of sites in ha (sites over 5 ha).

effectiveness of the geometric definition of survey units in comparison to individual fields (Cherry *et al.*, 1991: 53–4).

Obviously, the definition of the character and function of each of these very small sites would be a valuable contribution to understanding the pattern involved. On some occasions, when characteristic features of specific industrial or agricultural activities have been identified, usually belonging to more recent periods, one may assume specialised sites possibly with non-permanent residents. On the other hand, there are several sites, dating to pre-Hellenistic periods, where substantial archaeological deposits with a variety of artifacts, combined with architectural features such as stone built fortification or retaining walls on top of precipitous hills, indicate permanent and sometimes long-term habitation. In between however, are found numerous sites where the usually isolated cluster of sherds, with the occasional tiles, stone tools and the very rare building materials are of little help for the identification of the function of the site. Sites of this type may belong to any period from the Neolithic to the Ottoman, with the notable exception of the Late Bronze Age.

The implications of the large number of very small sites for the intensity and size of human occupation in the Langadas area may be more clearly understood through a preliminary examination of the chronological trends of the total number of identified sites (Figure 3.7). The few Late and Final Neolithic sites (5500–3500 BC), demonstrate surprising large sizes, particularly if compared to Neolithic examples from the South (e.g. Cherry *et al.*, 1988: 175; Jameson *et al.*, 1994). They all exceed 1 ha, while one reaches the size of 12 ha. and another that of 30 ha. Rather than indicating a large concentration of population however, these large one-period sites have been related to a particular model of unrestricted, widely spaced habitation closely attached to the agricultural land. The pattern of settlement may be connected to specific agricultural practices advantageous for the heavy soils or the periodically inundated areas on which they are located (Andreou and Kotsakis, 1994). Consequently, the size of population even for the largest settlement would not have to exceed the modal size proposed for Neolithic settlements further south (Halstead, 1994 proposes a modal size of 50–270 persons) and could in fact have been even smaller.

The dramatic decrease of the mean size of settlements in the Bronze Age without any significant changes in the number of sites, may not then indicate a considerable change in population levels (0.7 ha mean size in the Late Bronze Age, during the later part of the second millen-

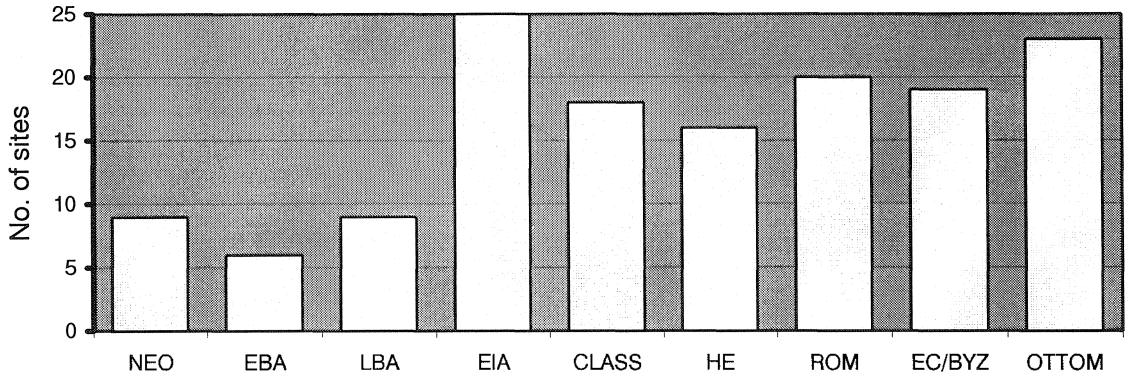

Figure 3.7. Frequency of sites by period.

nium). The survey has shown that the extensive occupation pattern of the Neolithic was abandoned during this period, in favour of nucleated habitation exclusively on long-lived tell sites. As a more likely alternative to demographic change it has been suggested that this shift in type and size of settlement was related to the adoption of an intensive agricultural regime in locations which offered more opportunities for diversification in the immediate area of the settlement. This shift which finds some support in the archaeobotanical evidence from Assiros, provided more security and perhaps better prospects for further intensification of production if required. In this respect, the new sites presented some obvious advantages over the Neolithic settlements. Indeed, the appearance of extensive facilities for centralised agricultural storage, and of substantial retaining or defensive earthworks, are indications that during the later part of the period some of the mounds may have started acting as centres of small and loosely organised regional networks with the aim of securing survival (Andreou and Kotsakis, 1994; Halstead, 1994). This development may have created some need for excess production but obviously it did not promote the formation of population aggregations of any size. In fact the total absence of any Bronze Age finds outside the immediate area of the tells is an indication of the restricted character of habitation and land use, and may further indicate a regime of communal land tenure.

It is in the subsequent period of the Early Iron Age (11th – 7th century BC) that the picture provided by the Langdas survey starts diverging more clearly from that presented by the surveys in southern Greece. During this period human presence in terms of both on-site or off-site finds is extremely low in most areas of the South (Bintliff and Snodgrass, 1985; Cherry *et al.*, 1991; Jameson *et al.*, 1994). In Langadas sites rise at this time to their highest peak (Figure 3.7). Significantly, most sites cluster in size under 1 ha. There are three sites larger than 8 ha where the EIA seems to form the earliest component, but at this stage the size of this component cannot be defined. On the other hand, most LBA tells continue into this period. At the same time many new sites in the form of small tells on hill tops were established, occasionally on high elevations reaching up to 500m. These are sites of permanent settlement with visible deposits, substantial architectural features usually in the form of stone built circuit walls, and finds of domestic character. Furthermore, some of them continue to be occupied in the Classical period. There are only a few scatters in low ground where it is not possible to establish the character of the site. It appears then that the Early Iron Age in Langadas could be described as a period of significant demographic rise. On the other hand the overall pattern of habitation and land-use implies a remarkable continuity in terms of political and social structure, whilst the expansion of sites in areas productively marginal denotes further diversification in the exploitation of the landscape, and a possible emphasis on a pastoral component (Halstead, 1994).

The difficulties in the dating of pottery, discussed previously, create serious problems in the detailed definition of settlement patterns during the following periods. It cannot be excluded therefore, that the drop in the number of sites at the beginning of the Archaic and the Classical periods (700 – 320 BC) was less marked than it looks. Nevertheless, few small sites certainly end and at least three sites during these periods exceed the size of 9 ha., being the first secure indication of population aggregation. The majority however, still cluster in the lowest size range. Furthermore, there is hardly any change in the functional characteristics of the small sites, and despite the appearance of larger nucleations, it is not possible to recognise any significant changes in the socio-political organisation, in the regime of land tenure or in the form of exploitation of the landscape. Very little, if any, off-site Archaic or Classical pottery has been identified outside the immediate area of settlements. This is only one of the many features which place the Langadas area apart from the regions surveyed in southern Greece in respect to this period. Very high densities of sites, some considerably large settlements, a variety of special purpose sites, a great wealth and variety in the inventory of finds are other differentiating features (Snodgrass and Bintliff, 1985; Cherry *et al.*, 1991; Alcock *et al.*, 1994; Jameson *et al.*, 1994). In fact while population levels

there seem to reach their limits, at Langadas it is only the appearance of three large sites that might indicate some rise in relation to the previous period.

In the following, Hellenistic, period the number of sites decreased even more but it was mainly the small sites which ended, and a number of medium and larger sites were established. In fact four sites exceeded 12 ha in size. The overall site area was increased during that period by 20% on average. On the other hand the appearance of isolated monumental graves away from the settlement may be the earliest definite indication for the disruption of the communal land tenure regime. It is no accident that the earliest indication of an organised town belong to the beginning of this period and come from the town of Lete. Sculpture identifying a sanctuary of Demeter, a number of inscriptions with administrative content, and a rich cemetery dated to the end of the 4th century BC are among the most prominent finds in this respect (Moutsopoulos, 1988; Hatzopoulos, 1994). The survey of Langadas identified the exact area of the town of Lete. Among the sites at Langadas this is the only one which has produced surface finds of monumental architecture. On the other hand, it will be premature to describe Lete as a centre in the sense of a southern Greek city.

During the Roman period more sites in the lowest range of sizes were established, indicating a turn towards more small-scale settlement, and a more extensive exploitation of the countryside. In this respect the situation may resemble that in southern areas, but probably differs significantly in terms of land tenure from the earlier pattern at Langadas (Bintliff and Snodgrass, 1985). Lete, which was located on the Via Egnatia, continued to be extensively occupied. No other major town has been identified in the western Langadas basin. For the subsequent periods, analysis so far has been limited and very little can be said besides the fact that during the Ottoman period large nucleated villages coexisted with some very small sites. The sites in the plain continue to be occupied, indicating perhaps another peak in the demographic history of the area.

Of particular interest for demographic reconstruction is the strong evidence for the intensive use of land during the Ottoman period. Some of the major settlements of the period are surrounded by a dense scatter of sherds, reaching several thousand per ha. Some of these scatters are related to the last remnants of the old field systems in the area, again around contemporary villages with an Ottoman past. The area covered reaches occasionally 40 ha or more. It is the only period at Langadas which is represented with certainty and recurrently by off-site distributions. The implications for the economic structure of the Langadas area and the detailed dating of this phenomenon are under study. Nevertheless, the intensity of land use around and between Ottoman settlements is a possible indication of a demographic rise. All other off-site scatters are very low and discontinuous, they cannot be related to specific sites and their dates do not form a coherent pattern.

Returning to the initial question concerning the low intensity of occupation in the North, the results of the examination of the Langadas area presented briefly here, appear to focus on two main phenomena: first the general low density of finds, characteristic both of the off-site and the on-site areas, and second the discontinuous scatter of artifacts. It is generally believed that low off-site density signifies a less intensive occupation and use of agricultural land, a particular land tenure regime and exploitation regime and indirectly, smaller population figures (Bintliff and Snodgrass, 1985; Wilkinson, 1989, 1994; Cherry *et al.*, 1991). Despite fluctuations from period to period in frequency and size of sites, the absence of off-site densities is a recurrent feature, with the sole exception of the Ottoman period and possibly the Late Byzantine. This evidence would seem to support low densities of population throughout the past in Langadas. On the other hand periods of population rise can be assumed irrespective of the off-site scatters. The case of the Early Iron Age settlement expansion of settlement shows a population rise, although the visible archaeological traces in terms of off-site scatter or artifact densities are still scanty.

On the basis of the example of Langadas, presented here in some detail, a number of general remarks can be made now by way of conclusion. One such remark is the interplay between long-term population trends and historical trajectories. Estimating the population of Langadas from quantitative survey information requires also the understanding of the particular economic and political structure of the region. We found no simple way to interpret our quantitative data without reverting to the more general picture of the area composed from various sources, most of them of a qualitative character. In this respect our interpretation is not – in the strict sense – unbiased. Rather it is founded on the eventual notion that Langadas is a provincial region (cf. also Bintliff, this volume), a notion which is supported by the relative silence of the historical documents.

Stressing the qualitative rather than the quantitative aspect of survey work can seem to be running contrary to the widely held opinion about the "new wave" of surveys in Greece. In our experience, important aspects of demographic reconstruction, such as defining the size and character of sites, was constantly proved to be a function of qualitative considerations interconnected with quantitative evidence. On the regional level, the interpretation of the low densities of finds needs to be considered in the light of historical context, covering such diverse events as the foundation of small polities in the Bronze and the Iron Age or the annexation of the region to the Macedonian Kingdom. In reality, all survey data are open to a multitude of interpretations: the very low off-site density and its absence from extended parts of the landscape can be related to low population, but it can also mean a varying economic and political system. From this point of view, the small number of sites at Langadas can be considered a tangible aspect of the historical trajectory of the region.

NOTES

1. All calculations have been based on the assumption that each fieldwalker scanned a 1m wide zone. Whenever needed for comparative purposes values are given in parenthesis for 2m and 5m wide scanning zones.

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4. Demographic Trends from Archaeological Survey: Case Studies from the Levant and Near East

Tony Wilkinson

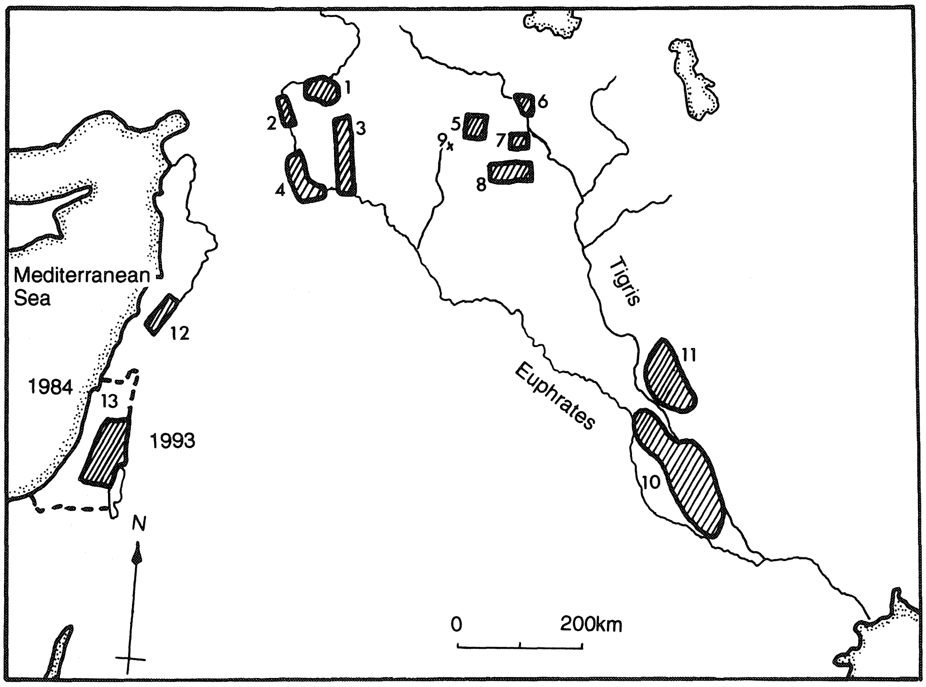
INTRODUCTION

Demographic information is fundamental to an understanding of many long held archaeological issues; notions of "collapse", migration and state development, spring immediately to mind, but the actual synthesis and presentation of demographic data are often greeted with scepticism by archaeologists, or are even ignored. This is unfortunate because archaeologists, especially those specializing in survey, have a virtual monopoly on really long-term population data. Since most studies of ancient human ecology require some statement to be made about population levels or density, it is therefore essential for archaeologists to tackle this problem and where possible at least to provide a sketch of demographic trends for their areas. The alternative is to find that demographers, historical geographers or others will use archaeological information, but may inadvertently misinterpret it, simply because archaeologists have not presented or analyzed their data critically. Even when dealing with the relatively data-rich Middle East, numerous problems remain in the calculation of past population levels; these should not be under-emphasized. Nevertheless, I argue that where the data permit, archaeologists should attempt to present long term demographic trends, making appropriate adjustments where necessary, and state explicitly where the problems lie, therefore providing a framework for other researchers. Opportunities for demographic reconstruction are considerable in the Near East, not only because of the wealth of surface remains, but also because of the existence of historical data in the form of cuneiform tablets that can provide crucial cross-checks on surveys (Brinkman, 1984). Yet as Brinkman has emphasized, historians and many others have been reluctant to employ the evidence of surveys (Brinkman, 1984: 170).

Because techniques of archaeological survey in the Near East and Eastern Mediterranean have improved the recovery of raw data, it is now possible to sketch some demographic trends. Here I will use selected data sources to make general statements about population levels through time, as well as potential inter-regional population fluxes within an area extending from the east end of the Mediterranean to the Mesopotamian lowlands. Emphasis is placed upon the critical examination of long-run population curves in light of the original survey record (and its imperfections), and the need for cross checks on site area data using other sources. In all cases discussed only sedentary populations are being considered. Owing to the difficulty of recognizing traces of former nomadic populations in much of the cultivated fertile crescent, this important component can only be inferred (for an example of the estimation of nomadic populations see Sumner, 1990).

First some problems and principles are stated. Using data derived from a range of archaeological surveys conducted over the past 30 years (Figure 4.1), I will address the following topics: the gross interpretation of demographic curves; comparison of different population curves; inference of levels of regional population density and regional population flux; and problems of long-term population change, land use and collapse.

To estimate regional populations from site survey data it is necessary to establish the reliability of the survey, that is what proportion of sites was actually recovered by the survey methods employed (for site recovery and full-coverage survey see Fish and Kowalewski, 1990). Even if the survey managed to recover a high percentage of all visible sites, sites of certain periods may be under-represented due to burial (for a general discussion of this problem see Sbonias, this volume). In addition to the burial of sites beneath alluvial/colluvial deposits, an issue that is best dealt with by geomorphological studies (e.g. Kirkby, 1977; Brookes *et al.*, 1982; Pope and van Andel, 1984), the blanketing of early occupation levels beneath later accumulations of mounding often characteristic of the Middle East can create problems. This is especially significant in the rain-fed farming zone such as in the north Jazira plain of Iraq, where the vast size of many sites results in occupations of chalcolithic and earlier date often being totally obliterated. Therefore when interpreting a demographic curve



1. Kurban/Titrish Hoyuks
2. Carchemish
3. Balikh (Syria)
4. Tabqa/Lake Assad
5. Leilan
6. Cizre
7. North Jazira Project
8. Sinjar/'Afar plain
9. Tell Brak
10. Tigris-Euphrates lowlands
11. Diyala
12. Biqa'
13. Israel/Palestine

Figure 4.1 Location of the main surveys used in text. Note that for Israel/Palestine 1984 refers to Broshi and Gophna (1984) and 1993 to Finkelstein and Gophna (1993).

such as Figure 4.2, it can be assumed that although we may get a fairly accurate picture for occupations of the third, second and first millennium BC, those of the fifth, sixth and seventh millennia will be progressively less well represented on the surface. Alternatively, in areas such as the Balikh valley of northern Syria, where Bronze Age settlement is much more attenuated (possibly because population was limited by the amount of available irrigation water), recognition of earlier periods may be improved. Thus what Mallowan perceived as a veritable backwater for Bronze Age archaeology is in fact a happy hunting ground for archaeologists of earlier prehistory (Mallowan, 1946; Akkermans, 1993).

The estimation of population from survey data remains a thorny problem and further methodological steps must be taken. First, it cannot be assumed that every site is evenly covered by each ceramic period recorded, and larger sites (e.g. those over one hectare) require sub-division into smaller units. These can simply be topographic units or arbitrary sectors, the area of which are quickly drawn up in the field. Alternatively and much slower, is the adoption of formal sampling strategies, which although visually impressive (see Whallon, 1979), when applied to survey universes in excess of 100 sites, can seriously slow down both the collection and processing of surface material. If no site subdivisions are made in the field then certain adjustments must be made in order to estimate the various ceramic components of the site (Sumner, 1990: 5–6).

Even though a general range for site populations of the order of 100–250 persons per ha has been established for certain parts of the Near East (Kramer, 1980; Hassan, 1981), recent work at Abu Salabikh in southern Iraq suggests that much higher site population densities in the range 248–1205 per hectare are possible (Postgate, 1994). Similarly high figures may have operated for Roman-Byzantine towns in Palestine (Broshi, 1980: 1). However, in a review of settlement and population in EBII/III BC Palestine (c. 2900–2300 BC), Broshi and Gophna (1984) suggest that earlier figures of 400 - 625 persons/ha are probably too high. Instead based on Marfoe's estimate of 200–250 persons per ha from Arad (Marfoe, 1980) and Shiloh's established range of ca 270 persons per ha (based on 50–58 dwellings per ha [Shiloh, 1980]), they employ 250 persons per hectare for population estimates. This was later reduced to 200 for estimates in the Hill country and coastal plain of Palestine (Finkelstein and Gophna, 1993). Conversely, based on excavation data derived from the Balikh valley, P.M.M.G. Akkermans has employed much lower figures for Neolithic and Halaf period settlement as follows: 15–25 persons per ha (Sabi Abyad), 24–40 persons per ha (Khirbet Shenef) to 45–75 persons per ha (Damishliyya) (Akkermans, 1993: 167). Such a wide range of

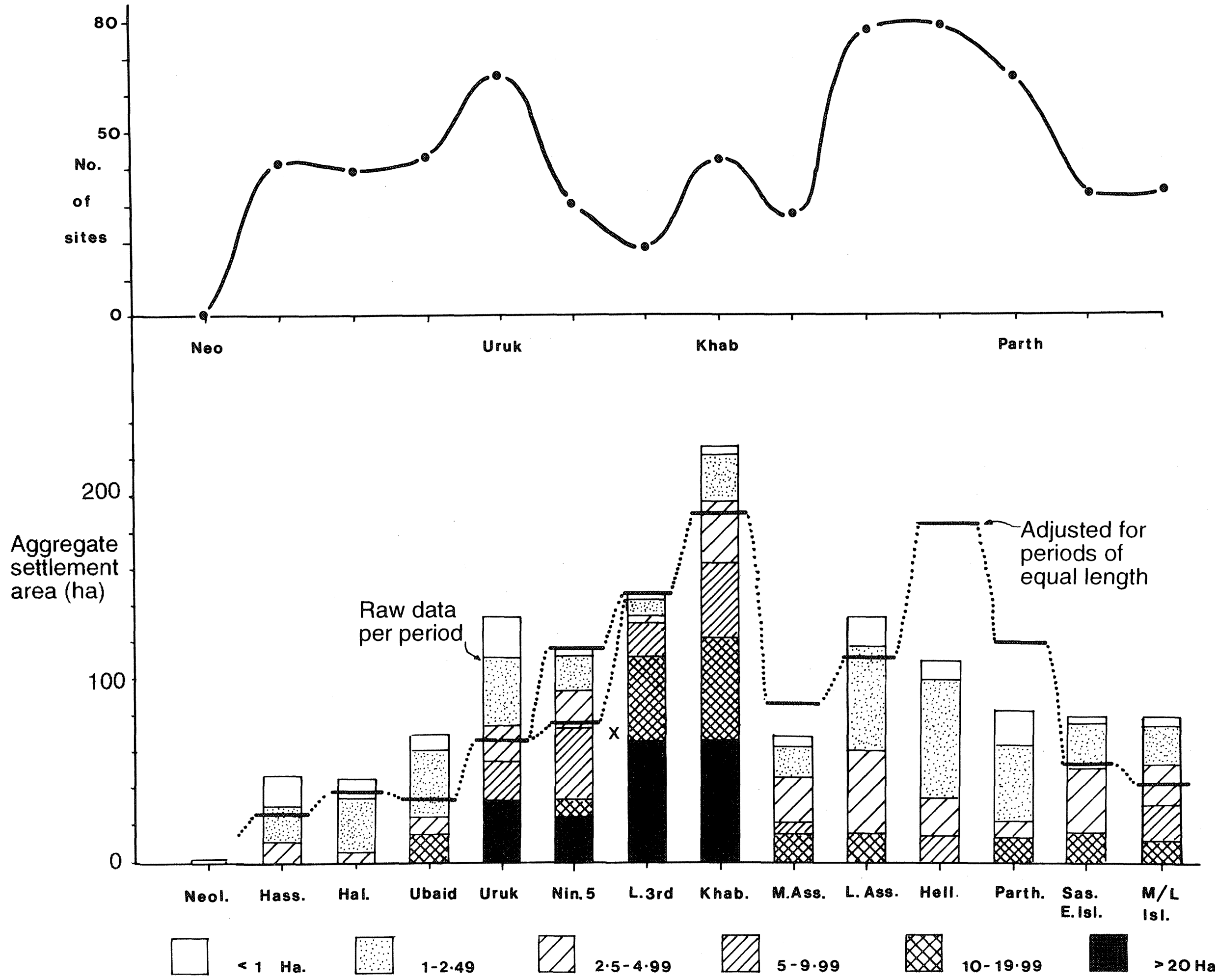


Figure 4.2 North Jazira Project, Iraq. Top: Number of sites for each archaeological period. Below: Aggregate site area for each period, adjusted for ceramic period of different lengths.

estimates provides a very pessimistic background for the estimation of past populations from site area. This pessimism partly stems from attempts to estimate populations of individual sites; if on the other hand the number of people per occupied hectare is used to estimate regional populations, accuracy can be improved considerably (De Roche, 1983). Nevertheless the above population estimates per hectare only apply to the Near East; and it is best to employ baseline data derived from the area in question, if it is appropriate. Given sufficient data in future, one alternative to the application of a single "magic number" is to employ a variant on the allometric growth model, used by remote sensing specialists, to estimate settlement populations as follows:

P = aAb or log P = log a + b log A

where P is the estimated population and A is the built-up area of the settlement. a and b must then be determined for the area (or period) in question (Lo, 1986: 53).

Alternatively if the more generally accepted figures of 100 to 250 persons per hectare are considered appropriate, then it is necessary to take into account such a range when modelling past populations. For example, sustaining areas can be calculated for lower and upper limits of say 100 and 200 persons per occupied hectare. If these provide a landscape in which settlements are plausibly dispersed in relation to resources and there is no sign that demand for food from the settlements would exceed the capacity of the land to supply it, then it is likely that population estimates are at least within an acceptable range. Taking such principles a stage further, when examining relationships between land use and population, a range of potential populations, for example 100, 150, 200 and even more per occupied hectare can be employed to see how the system might respond (for an example of this, see Wilkinson, 1994: figures 13, 14 and 15). Given the range of variation of on-site population estimates however, it is probably best to present a basic figure of aggregate site area (in ha) per unit area (either per 10 or 100 sq. km) for each ceramic period or unit of time.

The time axis presents an additional problem, because for lengthy ceramic periods, not all sites yielding the same

type of pottery will have been occupied at the same time. Alternatively, within any given site not all areas with a certain pottery type were necessarily occupied through that period. Such factors can have a significant effect on population estimates for certain critical phases (Weiss, 1977), therefore further adjustments are required in order to produce a long-term demographic curve. This problem can be tackled, to a degree, by developing finer ceramic subdivisions, but unless such subdivisions can be decreased to a few human generations, over-estimate of occupied areas may still result. Here a simple example is employed to illustrate the basic problem (below), but more sophisticated techniques using probabilistic models of site abandonment and creation can be used to simulate population dynamics (Dewar, 1991; Neely and Wright, 1994: 201–211).

Because the above population estimates are based upon site area alone, cross-checks are advisable using estimates of site territorial area. Potential cultivated area can be established by means of Thiessen polygons. Although providing a notional view of potential area, by assuming that territorial divisions lie half-way between sites, Thiessen polygons make no allowance for variations in site size. More independent, because they rely on non-site data, is the use of off-site pottery scatters. If such scatters are accepted as resulting from the spreading of household refuse as manure on fields, they can provide an estimate of intensively cultivated land for certain periods (Wilkinson, 1982, 1989). This record can then be supplemented by the pattern of ancient "hollow way" roads that radiate out from sites and fade out towards the margin of cultivation. These provide a more realistic estimate of the total area of available land for the community from which they radiate. By combining such data sets (Wilkinson, 1994: fig. 8) more secure estimates of potential population can be obtained. These can then be compared with those estimated from the surface area of sites. In this way it has been shown that Bronze Age centres in Upper Mesopotamia, although supportable during years of normal or high production, often needed to import produce from adjacent catchments (if available); the alternative being drastic shortfalls in food and potential collapse (Wilkinson, 1994). Individual sites or site complexes cannot therefore be seen as static entities depending upon a fixed supply zone, but rather are dependent on fluctuating zones of supply, which are influenced by climatic and land use fluctuations. Unfortunately, because off-site data provide supporting information on site population only for selected periods, they are neither available nor interpretable for every period; consequently they only provide supplementary support for on-site data.

Given the problem of estimating population from site area alone, it is therefore advantageous to provide dual estimates, by using site area on the one hand, and territorial area on the other, to see how the estimates agree. Because the relevant off-site data are unavailable for most periods or surveys, here I have adopted the expedient of using aggregate site area as a proxy for population. This choice means that only as long as on-site population density remains constant through time, (itself not necessarily true, see Sumner, 1989), will shifts in aggregate site area reflect equivalent shifts in population. Consequently, population estimates are given, when available, in the form of lower and upper population estimates based on both 100 and 200 persons per hectare.

The scale of the region surveyed will also affect the population curve. Not only are small areas likely to have been surveyed more intensively, but small territories (e.g. those less than 10 km radius) can exhibit a considerable flux of population because there is a greater probability of people leaving such a small area to go elsewhere. Conversely, regions of the order of hundreds of thousands of sq. km will accommodate a large amount of local population movement and will presumably lose fewer people to outside the defined region (although here boundary effects may be significant). This factor of "frame dependence" (Bronson, 1975: 68) must therefore be borne in mind when constructing population curves from small survey areas.

Bearing in mind the above problems, in many parts of the Near East it remains feasible to estimate roughly population trends for at least the last 9 to 10,000 years. Qualitative impressions of demography can also be obtained by comparing short-run curves, or by examining, for example, peak populations for different areas (examples of these different approaches will be supplied below). In order to establish population flux from area to area (or alternatively differential growth), long-term population curves from contiguous regions can be compared to provide an impression of which areas experienced increasing population, and which declined at any given time. Finally, documentary evidence can provide a cross-check on survey data. These issues are all examined below.

GROSS INTERPRETATION OF POPULATION CURVES

Because the estimation of length of occupation periods, site size and total population all present problems, it is appropriate to consider whether much can be read even at a gross scale from long-term demographic curves. Here an example from the North Jazira plain of northern Iraq is used to indicate some of the benefits and pitfalls of long-term demographic curves. Comparing the number of occupied sites per ceramic phase (Figure 4.2: top) and aggregate site area (below) it is evident that at times when sites are frequent, aggregate site area (taken as a proxy for the number of inhabitants) is at best modest. Conversely, when large aggregate areas are recorded (e.g. during the later third and early second millennium BC), sites are relatively few. This suggests, for the region in question, that the number of sites is a poor predictor of aggregate

site area and therefore total population. Furthermore, the decline in site numbers and increase in aggregate site area between 2,500 and 1,500 BC is primarily a result of population nucleation into urban centres (occupations >20 ha are in black).

The main curve (Figure 4.2: below) shows quite clearly that rather than there being a progressive increase in settlement through time, following the abrupt decline after the Khabur period peak (i.e. early 2nd millennium BC), aggregate settlement area never fully recovers, and rather progressively dwindles through the first millennium BC and AD. Whether this decline results from progressive desiccation since around 2000 BC, (an attractive but still unproved phenomenon), or is a result of political/socio-economic factors, is unclear.

The burial of early occupations beneath later levels probably results in aggregate areas for the Neolithic, Hassuna, Halaf and Ubaid being under-estimated. On the other hand because the ceramic periods themselves are long, it is almost certain that many sites that are described as belonging to the same ceramic period may not in fact have been occupied at the same time. If it is assumed that these two factors counteract each other, the illustrated curve may represent the trajectory of population increase through time. Here I have illustrated raw figures per ceramic phase (from Wilkinson and Tucker, 1995) together with periods adjusted to take into account the different chronological length of each period. The political history of dynasties are not used as chronological markers because the archaeological data do not necessarily fall conveniently into such categories; therefore when named they are merely employed as convenient signposts. Unfortunately it is impossible to adjust for burial, but presumably this factor becomes more serious for the earlier phases. The adjustment for chronological phase however does entail some significant changes to aggregate site area. For example, although calculated populations for the early third (Ninevite V period) and later third millennium BC remain unchanged, populations for the chronologically-extended Uruk phase would be significantly decreased. If on the other hand we accept Schwartz and Weiss's (1992) lengthened Ninevite V period (i.e. 3,300–2,500 BC), aggregate area would be decreased as indicated on Figure 4.2 (x), thus making the mid-third millennium urban expansion that followed more of an explosion. The early second millennium BC (Khabur) peak decreases slightly, whereas the Middle Assyrian population increases. In general this decrease in the amplitude of the curve seems reasonable. Following this, the slight downward adjustment in the Late Assyrian figure is entirely arbitrary owing to uncertainties in the definition of "post Assyrian" pottery, which apparently continued in use after the fall of Nineveh in 612 BC (Curtis, 1989), but for an uncertain period of time. Neither is the adjusted Hellenistic figure entirely justifiable, but whether the raw data are more acceptable or the adjusted, is a matter of opinion.

Whether one excepts the raw data or the adjusted figures, what is interesting is that there are essentially two cycles of population growth recorded for this area. The earlier is one of growth in association with urbanization, culminating in peak urbanization between the mid-3rd and early 2nd millennium BC. The later cycle is entirely different, being based upon increased rural settlement in the Late Assyrian period.

The increase in the number of settlements and, to a lesser extent aggregate site area, between the Middle and Late Assyrian periods (i.e. c. 1,300 to the early 1st millennium BC) resulted in the infilling of pre-existing gaps in the settlement matrix (Wilkinson and Tucker, 1995: 60–62). This can best be explained as resulting from the resettlement of population by Late Assyrian kings (Postgate, 1974). Such programmes, which increased in their scale especially during the 8th and 7th centuries BC (Oded, 1979), by encouraging rural settlement and the cultivation of wasteland, must have increased the productivity of the Assyrian economy. In turn this would have enabled the growing capitals to be provisioned. The impact of resettlement programmes has already been observed in the archaeological record for the Tel 'Afar plain (Oates, 1968a) and in the North Jazira, the open land that existed between the Middle Assyrian settlements could have been transformed from "waste" to cultivation by such a policy. There is no indication whether such colonization was piecemeal or occurred at one time; nor is it possible to say whether there was ever a total collapse of Middle Assyrian settlement that made the entire plain free for re-settlement. From the north Jazira evidence however, the Late Assyrian settlement programme appears to have been one of infilling, with a total of some 32 new settlements being established on former marginal or other land (Wilkinson and Tucker, 1995). This either acted as the template for the rural settlement pattern that followed or it was followed by increased settlement (in terms of aggregate settlement area) in the Hellenistic period, followed by a decline (fairly rapid or gentle depending on whether the adjusted or raw figures are used) which continued up until the late 19th century AD.

The above example suggests that demographic curves based upon aggregate settlement area can provide valuable insights into at least the gross pattern of population change through time. Nevertheless, the interpretation of the details of up and down-swings in population remains elusive, and will probably remain so until ceramic chronologies are considerably improved.

RURAL VERSUS URBAN SETTLEMENT

Archaeological surveys in the Middle East have in the past been conducted at a fairly coarse level, with major mounds being consistently recorded and smaller sites being under-represented. Even with increased intensity of survey and enhanced control in the form of aerial

photographs and high quality maps, the rural sector of settlement can still be under-represented. For example in the Balikh valley of Syria, detailed surveys by Peter M.M.G Akkermans recorded numerous sites ranging in size upwards from small prehistoric sites of less than 1 ha area (Akkermans, 1984). Because air photographs and soil maps provided the basis for the survey, where soil conditions gave ambiguous signals on the photos, sites were not entirely clear and were under-represented by the archaeological survey. Mounded sites of the Bronze Age (3,000–1,500/1,300 BC) were consistently recognized, however, whereas the rural component of smaller sites, which was virtually absent for the Bronze Age, was under-represented. Although a study of the archaeological landscape and regional geomorphology conducted by the Oriental Institute hardly increased the number of known Bronze Age sites, a steady trickle of Ubaid, Halaf, Iron Age (roughly Late Assyrian), Hellenistic and later sites were recorded. The pattern of later (i.e. post 1,000 BC) settlement dispersal can therefore be roughly demonstrated by the count of newly discovered sites. Settlement was primarily rural during the seventh, sixth, fifth and fourth millennium BC, became urban (or at least nucleated) during the 3rd and 2nd millennium, after which the nucleated centres again declined as rural settlement increased from about 1,300 BC on (Wilkinson, 1998). Two cycles of settlement are again discernible and are roughly contemporaneous with the demographic peaks in the north Jazira of Iraq, but unlike the north Jazira, these represent episodes of settlement pattern rather than quantities of people.

SOME LONG-TERM POPULATION CURVES (Figure 4.3)

Archaeological surveys conducted over the past 30 years have enabled long-term population curves to be constructed for Lebanon (Marfoe, 1979), lowland Iraq (the Diyala plains and the Tigris - Euphrates plains, based upon Adams, 1965 and 1981), northern Iraq (Wilkinson and Tucker, 1995) and the "hilly flanks" of southern Turkey (Wilkinson, 1990). Here, population is expressed as persons per sq. km on the assumption that site areas contain 100 persons per hectare for the data of Adams and 100 to 200 persons per ha for my own data (lower and upper estimates respectively). Marfoe's original figures are retained, because his allocation of 125 persons per ha for the rural sector and 200 per ha for the urban cannot be easily converted. Obviously such data should be compared with caution, partly because of the massive differences in scale. Note that the Kurban Hoyuk area is less than one quarter of that of the north Jazira, which is only about 6% that of the Diyala. Nevertheless despite these scale differences it is noteworthy that the Kurban Hoyuk area, rather than exhibiting a much higher population density than that of the largest areas, is roughly comparable. These relative densities will be commented on below. It should also be noted that the curves have been plotted according to their original authors, or in the case of the Tigris-Euphrates lowlands according to Whitmore *et al.* who re-plotted Adams' original data in graphical form (Whitmore *et al.*, 1990). Note that because Whitmore *et al.* combined data from both the Diyala and Tigris-Euphrates plains, the data of Figure 4.3a is contained within that of 4.3b.

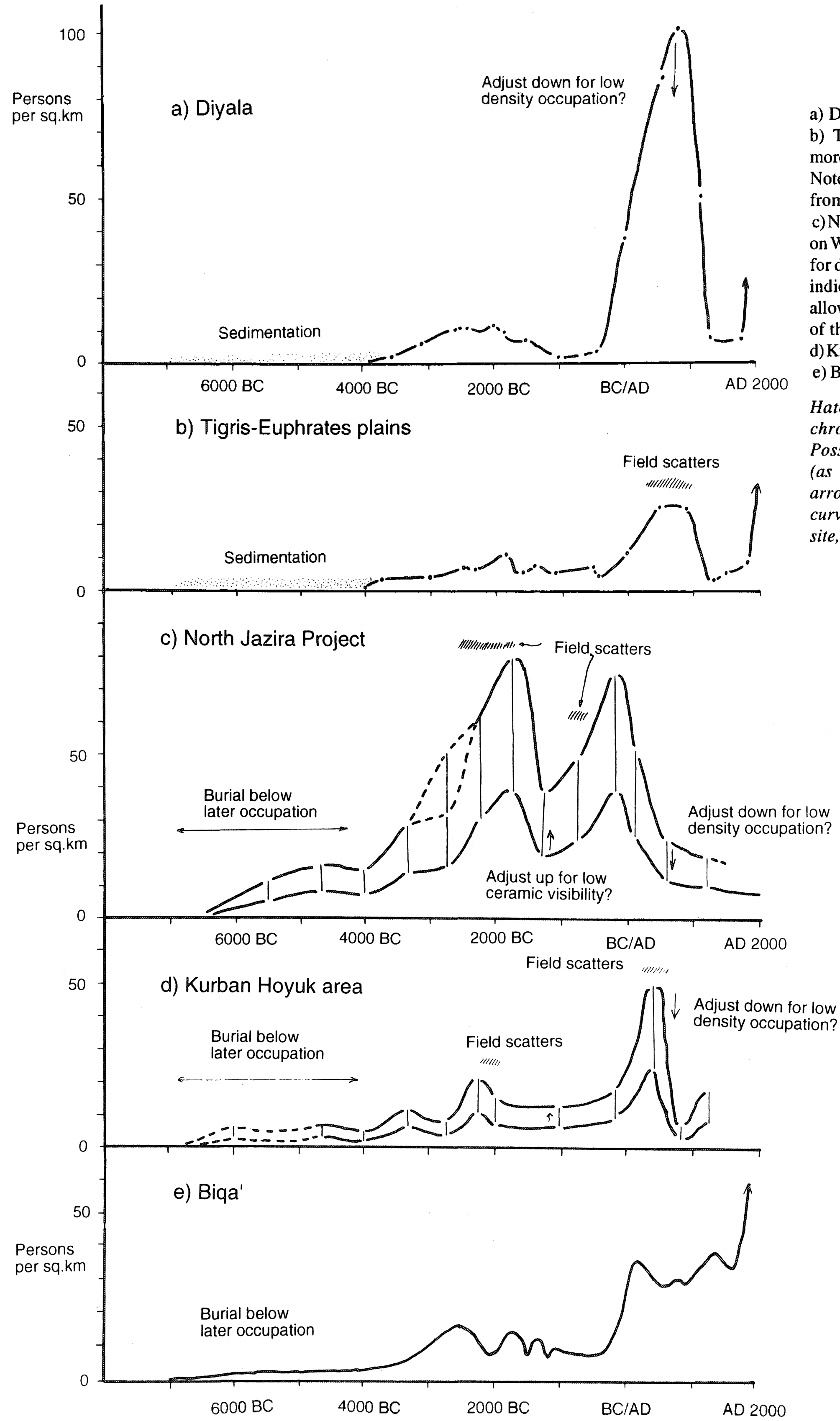
In addition to scale, other problems that influence comparison of the curves include: variations in alluviation, burial below later occupations, low ceramic visibility, lacunae in knowledge of pottery, variations in on-site population density, shifts in local population concentration (Brinkman, 1984, and see discussion), and factors that influence site definition. The last-named include sedimentation around site perimeters as well as the presence of off-site field scatters that can be confused with low density peripheral occupations.

Negligible population levels before 4,000 BC for both the Diyala and Tigris Euphrates lowlands are presumably the result of massive alluviation on the respective flood plains, a factor which is only compounded by burial below later occupations. The latter consideration, already noted for the north Jazira, must also have depressed population estimates for the Kurban Hoyuk and Biqa' areas as well. For the Kurban Hoyuk area upward adjustments may be necessary for much of the second millennium BC owing to the poor state of knowledge of the ceramics when the sites were surveyed. Similarly for the third quarter of the second millennium in the north Jazira an upward adjustment is probably appropriate to account for the rather low visibility of the drab chaff-tempered Middle Assyrian ceramics.

In most cases the adjustments tend to smooth the curve out, witness the upward adjustments in the 2nd millennium BC in the North Jazira and Kurban Hoyuk areas. Nevertheless, in the North Jazira, any adjustment for the later part of the curve would reinforce the already significant decline that is apparent, because in this case, site topography suggests that settlements were dispersed, low-density straggles of buildings. This is reminiscent of newer foundations, which, as Sumner has pointed out, exhibit lower population densities than long-established sites (Sumner, 1989).

Field scatters - namely dispersed scatters of low density sherds across fields around sites - can increase the apparent size of sites, especially in areas where wind deflation has concentrated surface sherds to levels in excess of those normally found on sites. For southern Mesopotamia, although these may have influenced site size estimates for the later post-Seleucid phases, I have accepted Adams' original estimates. However the presence of field scatters potentially may provide supporting evidence of high population densities as the following example illustrates.

Preliminary evidence suggests that periods of inferred maximum land use intensity coincide with peaks in



a) Diyala plains, Iraq (Adams, 1965)
b) Tigris/Euphrates plains, Iraq (Whitmore et al., 1990, based on Adams, 1981). Note that this curve incorporates the data from the Diyal
c) North Jazira Project, northern Iraq (based on Wilkinson and Tucker, 1995). Adjusted for different lengths of ceramic periods as indicated on Figure 4.2. The broken line allows for different estimates of the lengths of the Ninevite V period (see text)
d) Kurban Hoyuk, Turkey (Wilkinson, 1990
e) Biqa' valley, Lebanon (Marfoe, 1979).

Hatched areas indicate approximate chronological range of field scatters. Possible adjustments that could be made (as discussed in text) are indicated by arrows. For curves c) and d), the upper curve is based on 200 persons per ha of site, lower 100 persons per ha.

Figure 4.3 Approximate long-term population trends for selected areas between the eastern Mediterranean and the Mesopotamian plains.

population calculated from aggregate settlement area (Wilkinson, 1989). Increased land use intensity is inferred in terms of increased inputs into the land, which in turn are recognized by the presence of field scatters. These are interpreted as resulting from applications of settlement-derived refuse as fertilizer on to fields (for discussions see Wilkinson, 1982, 1989; Bintliff and Snodgrass, 1988; Alcock *et al.*, 1994, and Miller and Gleason, 1994). In the Middle East population curves for three areas support this statement, and a number of other cases provide qualitative support.

First the curve of aggregate settlement area at Kurban Hoyuk in SE Turkey (Wilkinson, 1990) indicates that field scatters coincide approximately with peaks in settlement (Figure 4.3), in this case during the later third millennium BC and the mid-first millennium AD. Data from the north Jazira survey area in northern Iraq show field scatters existing for all periods since the early third millennium BC (Wilkinson and Tucker, 1995: figure 51), but with the number of diagnostic sherds being greatest for the later third millennium BC. Although not the period of maximum aggregate area (or population) for the entire region, this is the period of maximum population within that area that was occupied during the later 3rd millennium phase of settlement nucleation (Wilkinson and Tucker, 1995: 82). Note that although a weak field scatter coincides with a second population peak in the Late Assyrian period (early 1st millennium BC; Figure 4.2), this peak disappears when the raw data is adjusted to allow for differing lengths of ceramic periods. In southern Iraq, although Adams (1981) did not compile a long-term population curve for the main part of the alluvium, a curve based on his data (Whitmore *et al.*, 1990) demonstrates that population reached a long-term peak during late Sassanian and early Islamic time (between c. 500 and 1000 AD: Figure 4.3). Significantly field scatters around a number of sites in southern Iraq (Abu Duwari, Jemdet Nasr [Mackay, 1931] and Abu Salabikh-Zibliyat) all accumulated between the Hellenistic and early Islamic periods, at a time when population levels exceeded those of all earlier periods. Therefore, by Hellenistic and Parthian times, when population levels surpassed those of the Ur III and Old Babylonian periods, there must have been a need to increase production above that possible by means of traditional irrigated and fallowed cultivation alone. By the Sassanian and/or early Islamic periods, when population levels in the alluvium were approaching a long term maximum, when urban populations were considerable, and when agriculture was being intensified in order to accommodate new crops, additional sources of manure were therefore necessary. As a result, special composts were prepared and applied to the soil to raise yields still further (Watson, 1983: 125–26). Although such applications contributed to the sustainability of agriculture through returning nutrients and some organic matter to the soil, by encouraging annual cultivation salinisation could have occurred (Gibson, 1974). Furthermore, because certain manures, especially those of cattle, are rich in salts, this process can result in soils becoming even more salinized (Olson, 1987: 204). As a result, there is an increasing probability of crop failure due to salinization (Jacobsen and Adams, 1958). Whether such practices actually contributed to the dramatic decline of population that prevailed in the middle Islamic period in southern Iraq is, however, uncertain.

Other evidence suggesting that maximum land use intensity coincided with population peaks, can be found at late third millennium BC Tell Sweyhat and in the hinterlands of the Abbasid ports of Siraf and Sohar where field scatters all coincide with periods of maximum urbanization (Wilkinson, 1982, 1989). In the last two cases though, as in southern Mesopotamia, part of the inferred land use intensity may have resulted from the introduction of a range of crops that pushed the agricultural regime away from biennial fallow towards multiple cropping, with increased growth of summer crops (Watson, 1983: chapters 23 and 24). Nevertheless, there is no reason to see these trends as being mutually exclusive, because, as Watson points out, these agricultural innovations were associated with tremendous increases in urbanization, population and agricultural intensification.

REGIONAL POPULATION DENSITIES

Where long-term population curves from adjacent regions show coincidental peaks, population growth may have characterized broad areas. On the other hand, if a peak in one area coincides with a trough elsewhere population may have moved from the former to the latter area (see below). Survey data can also allow population levels for any single period to be compared regionally as indicated on Table 4.1 (based upon an extended range of sources for the later third millennium BC). Population densities for the EB II/III Levant were generally rather low (3.5–12 persons per sq. km: see Broshni and Gophna, 1984; Finkelstein and Gophna, 1993; Falconer 1994), but in favourable areas, such as the flood plain areas of the Biqa', populations were much higher. Fertile but semi-arid areas of upper Mesopotamia in northern Syria and Iraq, exhibit moderately high densities (c. 30–60 persons per sq. km), but the hilly flanks to the north within Turkey had population densities between those of the Levant and Upper Mesopotamia. In such cases, population densities seem to relate to available cultivated land within the rain-fed farming zone. In the Khabur and northern Jazira of Iraq, cultivated land frequently occurs over extensive and contiguous blocks of land, but where intervening hill masses intervene, such as is frequently the case in much of the Levant and southern Turkey, both potential cultivable area and regional population would be expected to decrease. This is well illustrated by Marfoe's Biqa' survey which demonstrated a wide range of population densities,

Region	Sub-region	Period	Density (per/sq.km)	Reference
Egypt		c. 2100 BC	51	1 Table 2.2
Levant				
Palestine	Hill country	EB II/III	3.5–7	2
Palestine	Coastal Plain	EB II/III	4–8	2
Palestine	Central hills	EB II/III	3–6	3
Palestine	Coastal plain	EB II/III	6–12	3
Lebanon: Biqa'	Survey area	EB II/III	8–20	4
Lebanon: Biqa'	Flood plain	EB II/III	6–120	
Hilly Flanks				
SE Turkey	Kurban Hoyuk	Mid/late EBA	11–22	5 Table 4.1
SE Turkey	Titrish Hoyuk	Mid/late EBA	21–42	6
Upper Mesopotamia				
N. Iraq	North Jazira Pr.	Later 3rd. mil.	30–60	7
NE Syria	Leilan	Mid 3rd mill.	29–58	8
Irrigated Lowlands				
Syria	Balikh valley	Mid 3rd mill.	7–14	9
S. Iraq	Diyala	ED/Akkadian	4–18	10
S. Iraq	Mesop. plains	ED/Akkadian	5.4	1 Table 2.1
Modern data				
S. Iraq	Mesop. plains	AD 1947	46	1 Table 2.1
N. Iraq	W of Tigris	AD 1947	8 (max)	11
N. Iraq	E of Tigris	AD 1947	30	11
Antalya area	Mountains	AD 1960s	1.8	12 Table 1*
	Coastal zone	AD 1960s	11.3	12

References
1. Whitmore *et al.*, 1990. Mesopotamian data based on Adams, 1965 and 1981.
2. Finkelstein and Gophna, 1993.
3. Falconer, 1994, based on data from Broshi and Gophna, 1984.
4. Marfoe, 1979.
5. Wilkinson, 1990: table 4.1.
6. Algaze *et al.*, 1992 and unpublished data.
7. Wilkinson and Tucker, 1995.
8. Stein and Wattenmaker, 1990.
9. Curvers, 1990: table 4.3.
10. Adams, 1965: tables 10 and 11 and chapter 9.
11. Oates, 1968b.
12. Allan, 1972. *Hypothetical carrying capacities only.

Notes: Population densities are given as a range based on aggregate settlement area in ha per 100 sq. km converted to persons per sq. km assuming that 100 to 200 persons occupy each ha of site (see text for discussion). Single figures refer to modern population statistics or to the computations of Whitmore *et al.* (1990).

Table 4.1. Approximate regional population densities for the mid-late 3rd millennium Levant and Near East calculated from survey data.

depending upon the land unit in question (Marfoe, 1979: figures 4 and 7).

In irrigated southern Iraq and SE Syria, regional population levels during the later third millennium BC are on a par with those of the Levant and significantly less than in Upper Mesopotamia. Although extensive survey methodologies and sedimentation probably reduced site recovery for the Iraqi data of Adams, this does not appear to be the case for the Balikh where survey enhancement confirms the accuracy of the original record of Akkermans (1984) and Curvers (1990). If the survey data are even approximately correct, it seems that although early Bronze Age population densities were high in the irrigated zone, regional population densities were held down because large tracts of desert, swamp and other non-cultivated terrain land must have existed between the corridors of irrigated and settled land. In both the Tigris – Euphrates lowlands and the Balikh valley it can be shown that human settlement was probably limited by the quantity of available irrigation water under prevailing conditions of technology (Adams, 1981: 6; Wilkinson, 1998). Preliminary calculations suggest that overall population densities in the irrigated lowlands were probably in the range 4–18 persons per sq. km as opposed to 50–100 that might be expected by the potential productivity of the land itself (Adams, 1981: 86–87). In other words, as in the hilly flanks and much of the Levant, the irrigated zone exhibits a patchy settlement record that translates into fairly low regional population densities. The significance of such figures is discussed below.

POTENTIAL POPULATION DYNAMICS (Figure 4.4)

Alternatively population flux, or at least differential growth can be suggested by the recognition of opposing trends in settlement in nearby areas. Given the extremely meagre data base that exists it is unduly naive to posit a shift directly from one surveyed area to another; nevertheless it is reasonable to infer that the respective areas might have participated in a general regional flux of population, that also included other areas as well.

For example, in the rain-fed zone of Syria, Iraq and SE Turkey, urbanization cannot have taken place in a vacuum, and the growth of urban settlements around the middle of the third millennium BC might have been accompanied by varying degrees of population flux, both at a local and at a regional (or inter-regional) level. Although some have argued for synchronous growth followed by region-wide collapse (e.g. Weiss *et al.*, 1993) alternatively a complex situation might have prevailed with initial Early Bronze Age urbanization taking place at varying rates in different subregions of upper Mesopotamia (Algaze and Wilkinson, 1994). Urban agglomeration in one area may have been at the expense of neighbouring regions, and urban decline in some places may have led to expansion elsewhere, either as a result of actual population movements, or as a consequence of differential growth.

Here I examine urbanization and demographic flux in eastern Anatolia, northern Syria and Iraq using the survey record to sketch the direction and scale of selected population trends. By so doing, urban or state collapse can be

thrown into sharper focus, and tendencies such as ruralization, as opposed to wholesale collapse may be identified. Emphasis is placed on factors such as the peak of urbanization in each area, or on the comparison of semi-quantitative curves from different areas. Although ideally a suite of demographic curves from a range of contiguous regions should be compared, this is not yet possible for the Near East.

The main survey areas examined are:

Kurban Hoyuk/Titrish areas near Samsat on the Turkish Euphrates (Wilkinson, 1990; Algaze *et al.*, 1992).

The Carchemish/Birecik area on the Turkish Euphrates (Algaze *et al.*, 1991, 1994).

The Cizre plain adjacent to the Tigris in SE Turkey (Algaze, 1989).

The north Jazira plain in northern Iraq (Wilkinson and Tucker, 1995).

The Leilan area in N Syria (Stein and Wattenmaker, 1990).

Upper Lake Tabqa on the Syrian Euphrates (work in progress).

Additional information is drawn from the Sinjar/'Afar plain in northern Iraq and the Balikh valley of Syria (work in progress).

Early-third millennium BC

Throughout upper Mesopotamia during the early third millennium BC (i.e. the earlier Early Bronze Age), sites appear to have been generally of modest size (<25 hectares) and dispersed. Locally, some population flux is evident. For example, in the north Jazira of Iraq, Ninevite V Tell al-Hawa may partly have grown as a result of withdrawal of population from an area immediately to the west. This area, which had been well populated during the Uruk/Late Chalcolithic, was essentially depopulated by Ninevite V times (Wilkinson and Tucker, 1995: figures 35 and 37). Because such a conclusion assumes a closed system, in reality people may instead have simply left the western area to go to other regions, but at the same time as the urban centre at Tell al-Hawa grew. Alternatively, being a marginal area, this western zone may have been abandoned because of declining fertility or as a result of an interval of dry climate towards the end of the 4th millennium BC. Therefore although a significant change in settlement can be inferred, to interpret this change in terms of direct movement of people to the nearest expanding place, although attractive, is not the only valid conclusion.

Mid-third millennium BC

Many sites in upper Mesopotamia attained their maximum area around the third quarter of the third millennium BC, i.e. when the Akkadian kings extended their rule to the NW of Mesopotamia. Urbanization at Kurban and Titrish Hoyuk (Kurban Period IV) in SE Anatolia seems to have been approximately in phase with that at Leilan in northern Syria (Leilan Period II), as well as with many sites in the north Jazira and Sinjar plains. However the situation was very different in the Cizre plain of SE Turkey where a moderately dense scatter of Ninevite V settlements was followed by a phase of virtual abandonment for the mid-late third millennium BC (Algaze *et al.*, 1991: figures 21 and 22). Decline around Cizre may therefore have resulted in a shift of population southward into centres such as Tell Leilan, as well as to Tell al-Hawa which also grew considerably around this time. This would accord with the conclusions of Stein and Wattenmaker (1990) who suggest that the Leilan II urbanization was too great to have resulted only from the in-migration of local people. Further east along the Syrian Euphrates, although Tell Sweyhat remained small, Selenkahiye and Hadidi attain urban scales in the range of 15–50 ha (Figure 4.4, top: the two sites SW of Sweyhat).

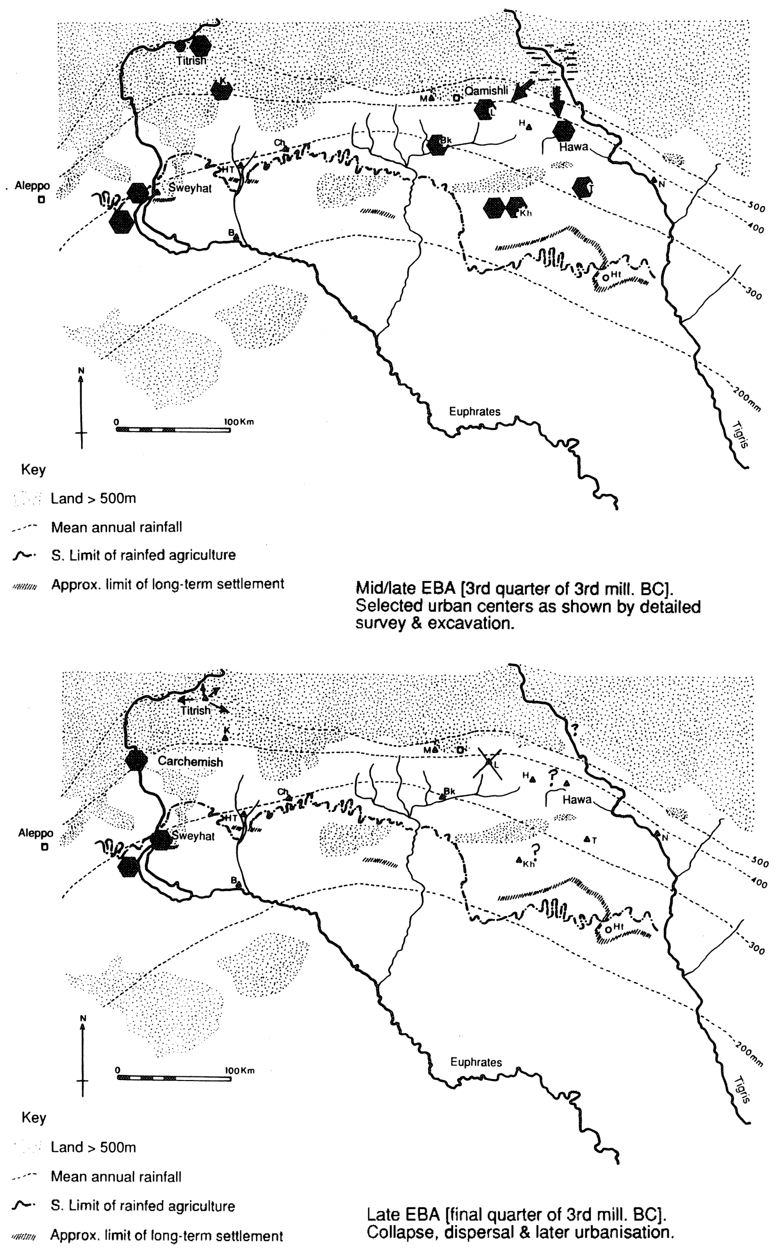
The final quarter of the third millennium BC

In the upper Khabur plain a hiatus at Tell Leilan immediately after the Leilan IIb urbanization resulted in Leilan and many other sites in the Khabur region being abandoned. However, whether other major centres such as Tell Brak (to the south) collapsed seems unlikely because both field evidence and radiocarbon determinations from Brak suggest that there was considerable occupation there after the Akkadian occupation (Oates and Oates, 1994).

Around Kurban and Titrish Hoyuk, settlement nucleation in the third quarter of the third millennium BC (i.e. during Kurban IV; Wilkinson, 1990; Algaze, 1990; Algaze *et al.*, 1992) was followed towards the turn of the millennium by the decline of centres and the dispersal of small settlements into the countryside (Kurban period III). Such a pattern, although representing a minor decline in aggregate settlement area, indicates neither abandonment of the area nor collapse, but rather suggests a phase of ruralization in which smaller self-sufficient communities appear to have replaced the more urban centres (Algaze and Wilkinson, 1994).

To the north of Carchemish on the Turkish Euphrates, during the final quarter of the third millennium BC (Kurban III), both the number of sites and aggregate settlement area showed a significant increase. A similar pattern obtained around Tell Sweyhat in Syria, where the site apparently increased rapidly in size in the final quarter of the millennium (Holland, 1976, 1977; Holland and Zettler, 1991). Ceramic parallels with late Kurban IV and early Kurban III suggest that growth occurred approximately synchronous with decline at Kurban and Titrish to the north. Sweyhat then declined to a small settlement of indeterminate size during the Middle Bronze Age until it was abandoned by c. 1,600 BC, at which time settlement retreated back to the river.

Among those sites occupied during the Leilan hiatus are Selenkahiye (Van Loon, 1979; Schwartz and Weiss, 1992: 237), Sweyhat and Qara Qozak (Olovarri, 1992),



Figures 4.4 Inter-regional population changes inferred from selected Early EBA, Mid/Late EBA (i.e. 3rd quarter of 3rd millennium), and Late EBA (final quarter of 3rd millennium) settlement trends in Upper Mesopotamia and SE Turkey. Sites: M=Mozan, L=Leilan (the cross [below] indicates its collapse during the late 3rd millennium BC), H=Hamoukar, N=Nineveh, Bk=Brak, T=Tell Taya, Kh=Tell Khoshi, Ch=Tell Chuera, B=Tell Bi'a, HT=Tell Hammam et-Turkman, K=Kazana Hoyuk.

all on the Syrian Euphrates. Of these both Tell Sweyhat and Selenkahiye declined significantly towards the close of the third millennium BC. Settlement trends in the irrigated Balikh valley of Syria, although less clear, suggest a decline, but not an abandonment, in the final quarter of the millennium (Curvers, 1990: 217). Away from the Euphrates there was continuity in settlement at Tell Brak during the final quarter of the third millennium BC (Oates and Oates, 1994: 173–74). In other words, a group of sites along the Syrian Euphrates, perhaps along the Balikh, as well as at Tell Brak in the Khabur basin, were occupied to a significant degree when Leilan was unoccupied. Although it is impossible to quantify to what degree population flux out of the Leilan area can account for such differential growth, total region-wide population collapse seems unlikely.

The above summary therefore suggests that during the second half of the third millennium BC there was either significant differential growth of settlements or some movement of population between different areas. In some

localities, urban collapse occurred but in other places it was coeval with ruralization, whereas elsewhere renewed urbanization occurred. Although such a sketch can hardly do justice to the complexities that must have prevailed, with the development of increasingly fine regional chronologies and population curves it should eventually be possible to refine the above picture.

DEMOGRAPHY, LAND USE AND COLLAPSE (Figures 4.5 and 4.6)

Long term population change can be represented by a number of growth models, the most common being the exponential curve, in which population increases according to a power law eventually to produce catastrophically high population figures. Alternatively, growth can occur via stages in which population increases in cycles, each phase of which has its own characteristic growth rate, either logarithmic or arithmetic (Hassan, 1981; Whitmore *et al.*, 1990). As the demographic curves above suggest, for the ancient Near East the latter model seems more appropriate with population curves exhibiting a number of cycles of rise followed by decline (Bronson, 1975; Whitmore *et al.*, 1990). If decline is abrupt or catastrophic, it can be described as a collapse. Recent interest in this topic has been raised by Weiss *et al.* (1993) who describe the abandonment of Tell Leilan at around 2,200 BC in the context of a major region-wide, climatically-induced collapse. Such a monocausal hypothesis presumes a direct relationship between climate (in this case rainfall), agricultural productivity and the amount of population that productivity can support. However, just as there can be many causes behind urban growth and population collapse (see Tainter, 1988; Yoffee, 1988), societies can also possess numerous buffering mechanisms that enable them to override climatic fluctuations. Nevertheless, in areas of marginal production such as upper Mesopotamia, rainfall fluctuations do influence the carrying capacity of the land, and the following model shows in a general manner some of the strategies that can result in adaptation to "normal" fluctuations in rainfall, and also indicates under what circumstances production shortfalls can occur and potentially can precipitate abrupt demographic decline.

Within a finite, bounded site territory, long-term population growth can be modelled by examining interactions between an initial population growth rate, a limited range of climatically-determined crop production values, various simple crop production strategies which incorporate minor changes of technology, and the transfer of products from adjacent territories. By holding the fluctuation of crop production values within a range currently expected for the region, we can simulate population increase under

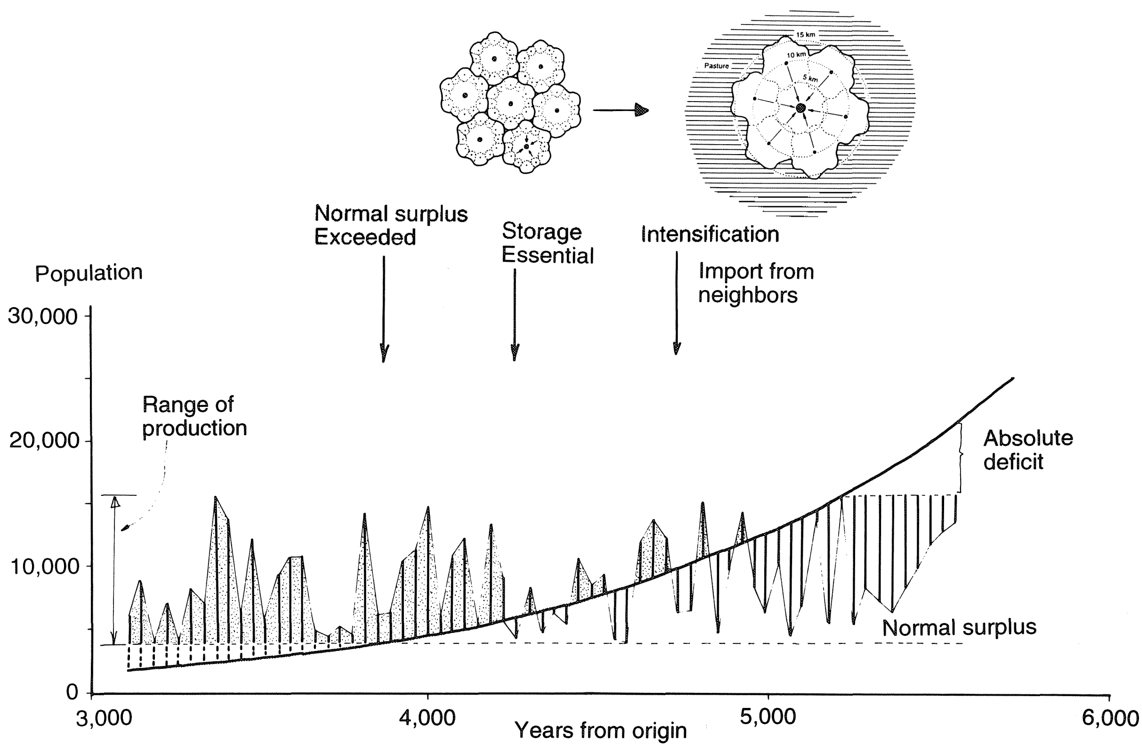


Figure 4.5. Exponential population curve (i.e. Model 1) showing strategies adopted in a single catchment area as population and stress on the production systems increase. Crop production figures (expressed in terms of the number of people they could support) are generated as a uniform random distribution between upper and lower limits (see text).

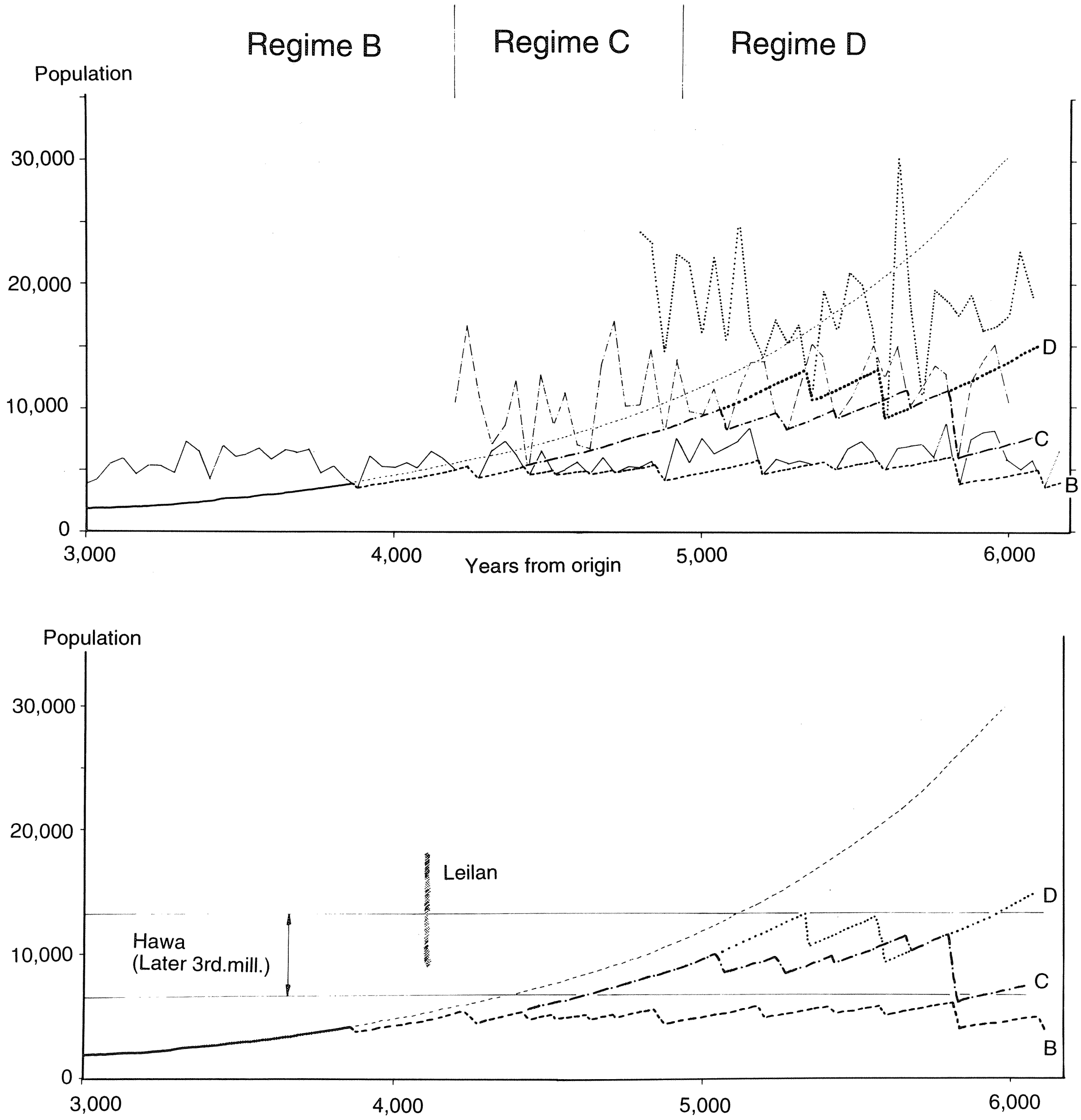


Figure 4.6. Model 2 depicting hypothetical population curves (top) that might result from production shortfalls under agricultural regimes (and carrying capacities) of increasing intensity (regimes B, C and D). The lower diagram is the same but omits the clutter of randomly fluctuating production figures. The likely range of population of two major early Bronze Age sites in upper Mesopotamia (Leilan and Tell al-Hawa) is indicated.

conditions of random climatic fluctuation. This is equivalent to a constant climate model in which only random rainfall fluctuations influence crop yield. We can therefore determine under what conditions population fluctuations might occur, and whether climatic fluctuations of a given order would be necessary conditions to initiate agrarian and therefore population collapse. This simple model only attempts to deal with the crop-production/climate system; other socio-economic factors potentially influencing collapse are not considered here (see for example Tainter, 1988 and Yoffee, 1988). In spite of these simplifications the model does serve to highlight a number of features of settlement system behaviour, and thus may enable researchers to assess which climate fluctuations might be sufficient to produce a collapse in population.

Because the use of population growth as an autonomous driving force behind state development and urbanization is ultimately questionable (Cowgill, 1974), it is only employed here as a hypothetical background and initial condition. Growth rates are held constant during periods of population increase, but will fluctuate if crop production falls short of that required to support the population. At each stage of development a number of outcomes are possible. Each outcome allows the system to remain stable, to collapse, or for a new higher level of the system to operate. Although in essence this is a version of an earlier model (Smith and Young, 1972), that model

assumed population growth as the driving force behind all subsequent change. The proposed model, instead, incorporates a range of crop production scenarios that allow for the intensification of production, as well as for enlarged zones of supply or improved technology. In its more developed stage the model also incorporates fluctuating levels of population and potentially allows for population growth to both lead to and result from changes in production (Netting, 1993; Morrison, 1994: 118).

Assumptions

1) Early Bronze Age settlements are nucleated and each significant settlement is surrounded by a production zone of five km radius. This production territory, which is based on the assumption that territorial boundaries occur approximately half way between contemporaneous centres, coincides with a reasonable return walk from the main sites. The model parameters derive from archaeological surveys conducted around Tell al-Hawa (North Jazira Project) where primary and secondary centres were 9–12 km apart, thus resulting in production areas of approximately 5 km radius. That territories attained this scale is suggested by the fade-out point of ancient tracks radiating from the central site and from surface sherd scatters considered to be the result of manuring in antiquity (Wilkinson, 1994).
2) Long-term population growth rate was 0.1% per year (equivalent to 10% per century). This commonly-cited figure for the prehistoric period (Hassan, 1981: 221) does not conflict with demographic growth rates computed for the North Jazira Project area (i.e. from the rising curve on Figure 4.2). Because constant population increase as a prime mover is an unrealistic assumption (Cowgill, 1974: 507) this is only used for the heuristic Model I. A second model (Model II) is then generated on the assumption that when production falls below population (i.e. the growth curve), population would potentially fall to a new, lower level, from which it would gradually recover again at the assumed growth rate of 0.1% per year. Although this scenario provides a more realistic picture than that of constant growth, it is still an over simplification, and, as will become evident, a number of strategies would operate to avoid population decline.
3) In rain-fed upper Mesopotamia, cereal production varies from year-to-year and is primarily proportional to rainfall fluctuation. Here, rather than model for rainfall fluctuation and then calculate the population that this can support, I have simply assumed a random fluctuation of production, either as a uniform random distribution between a range of upper and lower values (model I) or, as a random distribution normally distributed around a mean with specified standard deviation (model II). Here carrying capacity is estimated directly as the number of people the production could support within the specified territory, based on the assumption that annual consumption is approximately 250 kg of grain (or its wheat equivalent) per year. If another food product is eaten, partly as a substitute for wheat, wheat equivalent is counted as the amount of wheat used to exchange for that food (see Hillman, 1973). Fluctuations in potential carrying capacity are then applied to the same diagram as the demographic growth curve, in order to depict their co-variation through elapsed time from a hypothetical origin (Figure 4.6). The scenario for Model II, regime B, assumes a crop yield range of 350–750 kg/ha minus wastage etc. of 25–30% . Net crop yields range therefore from 250–500 kg/ha with a mean yield of 375 kg/ha every 2nd year (for discussion see Russell, 1988). This gives a mean carrying capacity for the 5 km radius catchment of 5850 with a standard deviation of 1464 people. This would be the standard production system of dry-farmed cereal cultivation under alternating years of fallow.
4) When production is considered to fluctuate at random between fixed upper and lower values, it is assumed that carrying capacity and population are determined by years of low yield. This concept of the "normal surplus" (Allen, 1965; Halstead, 1989) is based on the observation that traditional societies plant sufficient area to gain enough food in a year of low yield (i.e. not for a year of mean yield, which would result in periodic famines). This concept is also incorporated in the models that employ normally distributed random production figures, but in such cases it can be seen that the population growth curve, by declining when production falls below hypothetical population, automatically adjusts population to the appropriate low yield, with the result that there is a "normal surplus" in most years.
5) In model I, the basic cultivation strategy is that of biennial cropping without fertilization. A cereal yield of 250 kg/ha is assumed every 2nd year with intervening years of fallow. In good years a yield of 1,000 kg/ha is assumed, again every 2nd year, which gives a catchment carrying capacity range from 3,900 to 15,600 people. Uniform random productions within this range were then generated for Model I (Figure 4.5). Thresholds which indicate the approximate point where additional strategies (major storage, import from neighbouring territories, and crop intensification) become necessary are indicated. In model II, rather than assuming that the same crop-production strategy prevailed through time, increased production figures have been assigned when crop production falls below population more than 2 years in a row. Regime C assumes crop production of moderate intensity, namely manuring with biennial fallow. Cocks *et al.* (1988) in a study of dry-farming near Aleppo, Syria, give a range of 1,300–2,500 kg/ha,

which is double the local yield for traditional unfertilized biennial fallow. The range of production for regime C is therefore now assumed to be double that of regime B, that is between 500 and 1,000 kg/ha every second year, which gives a mean carrying capacity of 11,700 people with a standard deviation of 2,925. The final, most intensive scenario, regime D, operates under conditions of maximum demand. High intensity production with manuring without fallow is assumed across the entire area. Cocks *et al.* (1988) give cereal productions for this practice that are c.x1.5 the traditional unfertilized biennial fallow system. However, being practiced every year this gives the highest gross production. Here a yield range of 375–750 kg/ha every year is assumed, which raises mean carrying capacity to 17,550 with a standard deviation of 4,388.

The above strategies therefore allow population to rise as a result of increased levels of production. The above device of introducing new production regimes, although seemingly arbitrary, is employed to mimic assumed behaviour, that is when production potentially falls short, appropriate strategies are employed to raise production in the successive stages B, C and D (note that an initial stage A, relevant to early pre-urban stages of settlement has been omitted for reasons of space).

For simplicity the somewhat unrealistic assumption has been made that there is spatial uniformity of land use intensity. In other words there is, for example, no increase in fallowing away from the site (see Wilkinson, 1994 for models that make allowance for such variations). Stages B, C and D should not be seen as discrete evolutionary steps but rather as a continuum that is progressively adopted through time. Therefore, for example, during stage B, some areas of any given territory will only be at stage A levels of production whereas others, (probably those nearest the central settlement) would be producing at stage C. Such factors would blur the stage changeover points on the models.

Model outcome

Figure 4.5 shows Model I with an arbitrary time scale along the horizontal axis and a vertical axis expressed in terms of the carrying capacity of a 5 km radius catchment. The time scale is in relation to a hypothetical origin from which the curve was calculated at a growth rate of 10% per century. Because insertion of data at annual intervals would result in prohibitively large numbers of data points, for this illustrative model I have adopted an arbitrary spacing of carrying capacity values every 40 years. Actual thresholds and/or collapse points would therefore occur at rather different positions along the curve. Owing to the wide range of crop yields that would result from such a fluctuating pattern of rainfall, an equally large variation in population can be potentially supported from the given area; but because early communities probably operated on the principal of a normal surplus, most years of crop production would theoretically be in excess of needs. In reality such large surpluses would not result, either because the entire field area would not be sown, or if it was, some crop would be left perhaps to be grazed by animals. In any case limitations on available labour would tend to constrain the amount of land that could be planted or harvested (Wilkinson, 1994: 495–96). Storage of any excess grain would minimize waste as well as ensuring against crop failures in future.

For Model I, as population increases an initial threshold is reached where the "normal surplus" is exceeded. There then follow occasional episodes when production falls below carrying capacity. This would not be critical for the inhabitants because storage would enable such bad years to be ridden out with relatively little stress. From this point on however, storage becomes crucial for survival.

With further population growth there is an increasing probability that crop production within the site catchment would be less than potential population, until a point is reached when occasionally the production record would show two successive years of deficit. Although individual drought years would be survivable, either because of storage or because moisture carry-over in fallow would provide more stable crop yields, such back-to-back droughts (as defined by Parry and Carter, 1988: 23) may not. At such times stored surpluses would be seriously strained and at this stage if not before, the inhabitants might adopt the expedient of cropping every year, of introducing some form of fertilization or importing food from neighbouring territories (see below). Fertilization if combined with fallow, would represent a more sustainable high yield production system, but inevitably there would be a temptation to cultivate annually. In either case the enhancement of fertility would raise system carrying capacity, thus increasing the chance of survival for some time. Alternatively, the inhabitants (or the elites) could have opted to import food from neighbouring territories if this was feasible. Such tactics may have been the norm for extended periods of time, but with increased pressure on resources such transactions would tend to become more directional and of greater long-term importance. If annual cropping was introduced in conjunction with (or without) fertilization, by dispensing with the fallow year the soil moisture surplus of the fallow would be lost. Consequently crop failure would be more likely (Loomis, 1983: 360). At this stage it is evident that there are at least two outcomes for the system: a) survival at a new higher level of production, or b) collapse.

The alternative Model II introduces at key stages levels of greater cultivation intensity which result in increased production. These new levels are assigned where production falls below the carrying capacity of the site territory. As a result, population potential can rise further, until again a stress threshold is reached at which point collapse would be imminent, or a new crop production

strategy would be adopted. Secondary curves have been generated on the assumption that, when the curve of randomly fluctuating production falls below the population curve, population declines to the new production level and then subsequently recovers by continuing to rise at 0.1% per year, until production again falls below the rising population curve. As a result of these episodic disparities between potential production and population, the secondary curves (B, C and D Figure 4.6) have a saw-toothed appearance. Rather than being viewed as mass die-offs of population, such mutual adjustments could represent changes in fertility, death rate or simply emigration out of the area. Furthermore, the illustrated declines would probably be smoothed by increased storage, by the import of food or by other measures aimed at ensuring continuity of food supply. The three curves consistently fall below the hypothetical curve of population increase and fluctuate around what must have been the long-term carrying capacity of the 5 km radius territory. In one case the intermediate curve C even rises above the higher production curve D, but eventually settles between curves B and D.

As an alternative to a strategy of intensification, food could have been imported from neighbouring territories, but this would only have been possible if such neighbours had spare production, and if social and political relations between neighbours permitted it. The necessity of securing adequate supplies of food would therefore have encouraged cooperation and trade between neighbouring centres, with the result that perhaps a larger regional polity would arise in which there would be greater interdependence between individual components of the system. This would represent the crossing of a fundamental threshold, and would potentially allow population of the centre to rise still further, perhaps up to 10,000- 20,000 people, a figure which approximates to the maximum size of Early Bronze Age towns in Upper Mesopotamia (Wilkinson, 1994). At this point each system might comprise for example a large central town of up to 100–120 ha area, several secondary towns of 10–20 ha each up to a maximum of six, together with a number of smaller places of lower rank.

Beyond a certain point, in order to raise production still further, the most intensive cropping system, annual cropping with manuring, could have been adopted. By dispensing with the fallow year, soil moisture levels would be depressed and nutrients would be extracted annually rather than every other year. The system, although more productive in the short term, would therefore have been more prone to collapse. At such a point, if further import from neighbours was impossible, either because of political reasons or because they too were experiencing food stress, there would have been fewer alternative outcomes and at this stage again famine and population collapse would be most likely.

The above scenarios represent only a first attempt at simulating potential population trajectories within bounded catchment areas. Because different land-use strategies would result in higher or lower values of crop production, and population estimates from the central sites are only approximate, the scenarios remain tentative. However, it is evident that these population trajectories fluctuate within the estimated population range of large Early Bronze Age centres (see Leilan and Hawa on Figure 4.6 [below]) which suggests that each catchment was capable of supporting such settlements, but only with the assistance of occasional food imports from their neighbours. Changes in population would result from either immigration, emigration, or fluctuations of fertility and death rates, and the peaks and troughs illustrated would probably be further smoothed by variations in the implementation of storage, cropping intensity and import of food from neighbours. Furthermore, more advanced models could programme in a wider range of population growth rates, which would simulate more realistically real-world conditions. Nevertheless, by showing how population might rise and fall in no predictable manner in response to random climate fluctuations, such models may point the way towards more realistic long-term population scenarios.

DISCUSSION AND CONCLUSIONS

In order to present long-term population trajectories as unambiguously as possible, individual curves can be displayed in sequence, initially from raw data, but towards later curves that are more synthetic. The latter could incorporate adjustments allowing for variations in the estimated duration of ceramic periods, loss of the archaeological record by burial, varying perceptions of on-site population densities and variations in the "visibility" of key ceramic indicators. Not only should subdivisions of the chronological scale be of equal length, but also they should be as brief as possible. Not until these divisions are as little as 200–250 years will it be possible to produce curves of acceptable reliability.

The long-term demographic estimates suggest that population curves in greater Mesopotamia can be divided into at least two waves of growth and decline. Earlier waves dating to the later 3rd millennium BC are roughly contemporaneous throughout the region, but even these when analyzed in greater detail appear to break down into a regional mosaic of slightly varying trends of growth and decline (see above). In contrast, the peaks that follow clearly occur at different times. The most conspicuous difference is between the Tigris/Euphrates/Diyala lowlands and the north Jazira curve in the rain-fed north. In these instances, growth in the north in the 1st millennium BC coincided with a trough in the south. Such differences between rain-fed north and irrigated south suggest either differential growth or a shift in populations between the two areas. Population shift may also have involved a third region, not as yet studied. Growth in the north could have been at the expense of one of those parts of the empire that were drained of populations by the de-

liberate deportations instigated by Assyrian rulers. Significantly the decline in the south during the early first millennium BC is also a period when there was a marked dearth of cuneiform texts, which suggests at least a decline in literate or official activity at this time (Brinkman, 1984: 177). Moreover, survey data indicate that this decline was the culmination of a long-term trend that started around 2,000 BC. Population decrease was probably not uniform over the entire south however, and textual evidence demonstrates that the main region of occupation in the early 1st millennium BC had moved to follow a westward shift in the course of the river Euphrates, an area that was beyond the zone surveyed by Adams (Brinkman, 1984: 175–76) .

In contrast, the population peak of the 1st millennium AD in both the Diyala and Tigris - Euphrates areas coincided with a long-term decline to the north. At this time the south therefore became the main locus of growth, partly as a result of the extension of irrigation systems and related technology in the Partho-Sassanian period, which culminated in the construction of the massive Nahrawan system built in the 6th century AD (Adams, 1965).

Such dramatic differences between population trajectories during the later periods occurred elsewhere as well. For example, qualitative comparisons between the Kurban/Titrish areas and the Syrian Balikh valley to the south indicate that an Abbasid period (8th-9th centuries AD in this case) population peak within the Balikh (Bartl, 1996) conforms to a significant decline at this time further to the north.

From the early Iron Age on, populations appear to have been either very mobile, or regional disparities in growth rates were considerable. Although natural events such as the shift in the Euphrates, as well as droughts and famines may partly account for this, in other instances political decisions or social-economic factors may have been driving forces. The potential for comparison with textual and historical records is however considerable.

Whatever their shortcomings, the demographic data should clearly provide a stimulus for further investigations. For example in the north Jazira of Iraq the two demographic waves conform to two basic stages of economic-political organization in Upper Mesopotamia, the first being the development of city states within the Akkadian empire, and the second being that of more dispersed settlement within the Assyrian empire. Although the latter collapsed with the fall of Nineveh in 612 BC, it was followed by a number of empires: those of the Seleucids, Parthia, Rome and the Sassanian, all of which exhibited underlying similarities in their settlement pattern. Potential relationships between demography, settlement pattern and political economy are however beyond the scope of this paper.

The relationship between high population density and increased intensity of cultivation proposed by Boserup (1965) has come under spirited attack by some anthropologists and archaeologists, in part because earlier archaeologists lacked the data to test their case (e.g. Young, 1972). However, more recent results presented here for aggregate settlement area and field scatters imply that the latter do appear most strongly when aggregate site area (and therefore population?) attains its peak. More ominously, the demographic curves indicate that following population peaks and the appearance of field scatters, there is usually a precipitous decline in population. Although it would be overly melodramatic to suggest that field scatters indicate a desperate attempt by the population to maximize production in the face of imminent collapse, the relationship between population and field scatters is tantalizing. Also perhaps of significance is that none of the curves show a general upward trend until the modern age. It might therefore be argued that under the technology that prevailed, some Malthusian checks may have constrained population growth until these were over-ridden by the advent of modern economies, transport systems and technology.

The data also suggest that there were significant variations in population density between different regions. Indeed Adams' surveys in lower Mesopotamia (Adams, 1965 and 1981; Adams and Nissen, 1972), as well as that from Marfoe's Biqa' survey (Marfoe, 1979) indicate that long-term population change should be viewed within a context of spatial patterning that can sometimes obscure long-term trends. At the broadest scale the surprising, (and provisional) conclusion here is that regional population densities in irrigated Mesopotamia were relatively low compared with those of at least parts of the rain-fed north. Although here the enormous scale of Adams' surveys as well as the likely loss of sites beneath the alluvium may have depressed site recovery, population densities may have been constrained by the quantity of available irrigation water. Consequently settlement was concentrated in linear belts along channels (artificial or natural), rather than forming spreads of moderate density across large areas. In the late ED-Akkadian-Ur III period (mid-late 3rd millennium BC), although population densities in the irrigated south were probably very high along key alignments, the gross population of the entire region may have been equivalent to or less than that of the rain-fed Upper Mesopotamia comprising the Khabur, Mosul, Makhmur, Sinjar/Afar and Harran plains (for a similar argument concerning potential agricultural productivity see Weiss, 1986: 72). Population data therefore hint that we should not be looking at gross numbers of people or population pressure as a driving mechanism behind early urbanization and state development. Rather structural factors may have determined the developmental trajectory of these different regions: in the north where production, economic and social systems may have been primarily nodal, major states and cities did not develop to the degree that they did in the south, where converging and diverging networks of population and communications (in this case low-friction rivers and canals) may have been a key influence on the growth of early states.

When combined with short-run data the demographic curves suggest that population was probably remarkably fluid, particularly so after about 1000 BC. Thus increases within one area may have been at the expense of other areas that experienced decline. Whether such changes were a product of gross shifts in population or were simply a matter of differential growth is difficult to say.

Population collapse can be modelled for small, finitely bounded territories to suggest how with rising population, adjustments may be made in storage, land-use intensity and exchange of production. The models provide some support for the notion that agricultural regions surrounding major centres in Upper Mesopotamia were close to carrying capacity under prevailing conditions. That collapse did occur is not surprising, because regional population densities were higher during the later 3rd millennium BC than most other large areas of the Near East. Although not in itself disastrous, if such densities existed over very large areas, not only would there be significant stress on supply systems around any one centre during times of drought and crop failure, but competition between contiguous centres would be considerable. If all were suffering from production shortfalls, importation of goods would decrease and the probability of collapse would increase.

Given the nature of the data sources, it would be premature to endorse all of the apparent relationships noted above. More important is the need to establish fundamental principles for the reconstruction of past demographies. For this we need more estimates of site population densities from excavations, more finely divided ceramic sequences, and more detailed survey results. Furthermore there continues to be a need for the integrated use of survey and textual data to provide complementary data sets. Finally, it may be more fruitful to establish ratios between settlement and territorial area, as well as rates of growth in aggregate settlement area, thus avoiding the problems inherent in the estimation of absolute population figures.

POSTSCRIPT 3.6.98

Since the above was written, several publications of surveys have appeared which will influence interpretations of the demographic history of the region: Bernbeck, 1993 (Wadi Ajij eastern Syria), Lyonnet, 1996 (Khabur, Syria), Morandi, 1996 (Lower Khabur), Eidem and Warburton, 1996 (Tell Brak area, eastern Syria), Harrison, 1997 (Madaba Plains, Jordan), and Hole, 1997 (Jebel Abd al-Aziz area northern Syria). These provide additional information on population changes associated with irrigation (Morandi), the rain-fed farming zone (Eidem and Warburton, Harrison, Lyonnet), as well as very marginal areas of this same zone (Bernbeck, and Hole). Such surveys will not only contribute significantly to our understanding of the sedentary population but perhaps more importantly will contribute to an understanding of the mobile pastoral population, which for reasons of their visibility in the archaeological record, are inadequately dealt with here.

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5. Archaeological Proxy-data for Demographic Reconstructions: Facts, Factoids or Fiction?

John Chapman

INTRODUCTION

One of the principal characteristics of the archaeology of the last 30 years has been the repeated, if not insistent, attempts to use archaeological data for demographic reconstructions. A series of handbooks and textbooks has provided the ground rules for this undertaking (Acsádi and Nemeskéri, 1970; Harrison and Boyce, 1972; Hassan, 1981; Swedlund, 1971; Welinder, 1979), many of them admirably summarised in the chapter by Sbonias (this volume). In this contribution, I wish to examine some of the ground rules for the use of these data which I have found problematic in the study of prehistoric survey data in the Dalmatian zone of former Yugoslavia and in Hungary.

Any approach to prehistoric demography will require careful definition of likely, possible and impossible variables for study. It is essential to define those parts of the archaeological record which can be reached by intensive, systematic field survey. Unfortunately, there are relatively few variables on which archaeological data may be able to provide any hints of useful information, and none in which secure quantitative data are conceivable. Even if we select the simplest possible equation for prehistoric population studies, such as:

POPULATION = (BIRTHS + IN-MIGRATION) – (DEATHS + OUT-MIGRATION)

it is still rare to find robust data for birth and death rates (see Masset, this volume). And, despite the re-appearance of migration in theoretical discussions (Anthony, 1990; Champion, 1990; Chapman and Hamerow 1997; Gamble, 1993; Otte and Keeley, 1990; Renfrew, 1987), there are no direct quantitative measures of the in- and out-migration of peoples for palaeo-demographic purposes.

In short, palaeo-demographers have no alternative but to rely on what may be termed 'proxy-data'. Proxy-data are well-known to workers in other disciplines, not least climatologists and, even more so, palaeo-climatologists (Frenzel, 1992; Pfister, 1984; Wigley *et al.*, 1981). There are certain characteristics of proxy-data which may be summarized.

(1) proxy-data are by definition not explicit data for the problem at hand but rather indirect measures.
(2) proxy-data have their own sets of rules for 'local' interpretation and verification.
(3) proxy-data require interpretation and verification within their local rules before they can be used in other spheres of enquiry.
(4) proxy-data generally provide limited information for their problem, generally qualitative or semi-quantitative rather than fully quantitative.
(5) conclusions drawn from proxy-data require supporting evidence from another, preferably independent line of enquiry to be accepted as fully reliable.

The development of ground rules for the rigorous use of proxy-data may well be the most fruitful approach to improving the interpretation of field survey data. One of the most important tasks in this field is the search for independent lines of evidence against which to measure field survey results for the prehistoric period.

DEMOGRAPHIC PROXY-DATA

There are four classes of proxy-data commonly used in palaeo-demography: burials, structures, sites and ceramics. While the first class is dependent on large, excavated samples (e.g., Francovich and Gruspier, this volume), survey archaeologists regularly use the other three classes of proxy-data. By far the commonest of these classes is ceramics. It may be noted that field survey exponents are probably the last group in archaeology to make extensive use of the 'POTS = PEOPLE' equation, even in a modulated form! It may be that there is no alternative to the use of some such modulated equation.

It has been apparent for some time that the pressure is off population and that most archaeologists are not as over-reliant on demographic data as a prime mover as they were in the 1970s (Chapman, 1988). However, in Cherry and Shennan's (1978: 22) four questions to which

field survey can provide answers – arguably still the basis for the rationale underlying regional survey projects – population is still central to each question:- (1) how many sites are there in the area?; (2) how are these sites divided by period and function?; (3) how does their distribution relate to environmental factors?; and (4) how do the sites relate to one another? There can be little doubt that population's ceramic proxy-data (henceforth CPD) are still central to Mediterranean survey.

As long as one of the main aims of survey studies is the definition of diachronic change in a given region, there is strong pressure on survey archaeologists (and I am no exception) to provide bivariate information – i.e. using two basic unit of analysis – the site and the period. While much ink and not a little blood has been spilled on the issue of relating CPD to the entity of 'the site', not so much attention has been paid to the relationship between CPD and the entity of 'the period' (but see Cherry, 1979).

Despite all the theoretical and methodological drawbacks of the term 'culture' (for a recent summary of the debate, see Chapman and Dolukhanov, 1993), the majority of archaeologists makes pragmatic use of a cultural framework which is the legacy of Kossinna (1896) and V. Gordon Childe (1929). The cultural framework depends on CPD because they are the commonest available data. Hence, chronological phases defined by the presence/ absence of CPD are dated by various means to provide a diachronic framework for the use of the survey archaeologist. However, there is a price to pay for using these off-the-peg frameworks – a price best described as the tyranny of pot typology.

This specific tyranny is based on two theoretical assumptions – both concerned with theories of change. The first is that changes in the CPD record are correlated with other behavioural changes. The second is that the CPD record is therefore a better indicator of change than other kinds of data. These two mutually reinforcing assumptions take the much criticised 'chest-of-drawers' approach and fossilise it at the heart of survey archaeology, a criticism which led Plog (1969; 1973) to initiate the search for a truly diachronic anthropology, one where past temporal sequences were not inferred from spatial data. As with other tyrannies, the effect of this tyranny is to produce order where there was chaos. Such a tyranny generates a concern with boundaries – fixed, firm and reliable – and a tidy placing of all CPD records one side or other, or both. However, this approach reifies transitions and boundaries and goes a long way to excluding notions of continuous or gradual change, or change within stable pottery traditions. In particular, such an approach masks change within a period defined as 'stable' within a CPD definition. The potential for flux rather than conformity should be recognised in chronological matters, if the price of off-the-peg frameworks does not become too high !

In the remainder of this paper, I shall not simply be regaling readers with spoiler stories on the impossibility of doing demographic reconstructions. Instead, I shall attempt to define some answerable questions through which to explore CPD and settlement data. I should make it clear that my personal bias is towards people and places rather than people and pots – but, as I have stressed, concern with the latter relationship is inevitable.

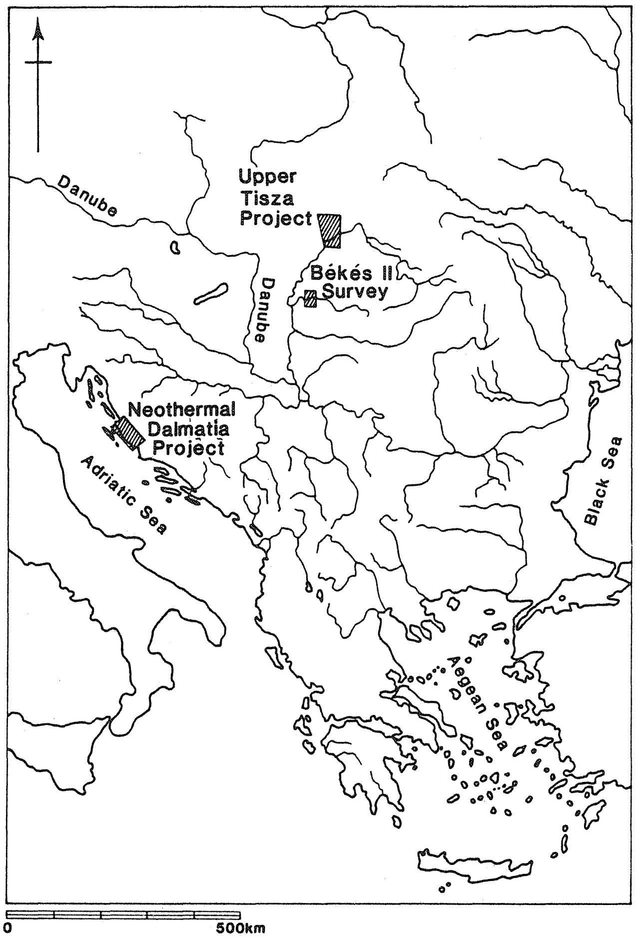

Figure 5.1 Location map of the Neothermal Dalmatia Project, the County Békés survey and the Upper Tisza Project.

A study of such answerable questions will be more comprehensible if some specific data are introduced. In this case, data from two contrasting regions will be considered – the limestone karstic Dalmatian coast of Croatia and the flat, well-watered plains of eastern Hungary (Figure 5.1). The first data set is derived from the multi-disciplinary research project the 'Neothermal Dalmatia Project' (henceforth NDP), based on the plain of Zadar and the adjoining Velebit Uplands. Here, teams from Zadar and Newcastle completed the systematic survey of c. 120 sq. km. of the Zadar lowlands, at an intensity of 5.5 person-days per sq km. A total of 230 prehistoric sites and 100 pre-Roman monuments was discovered (Chapman and Shiel, 1993; Chapman, Shiel & Batović, 1996).

The other data sets are derived from two different surveys in eastern Hungary: the MTA Archaeological Topographical Programme's work in County Békés (Janko-

vich *et al.*, 1989) and the more recent 'Upper Tisza Project' (henceforth UTP), a collaboration between Newcastle, Budapest and the three county museums of North East Hungary (Chapman and Laszlovszky, 1992, 1993, 1994)[1]. In the Békés survey, some 850 sq km were surveyed at an intensity of 1.5 person-days per sq km. ; a total of 734 prehistoric sites (comprising 1030 components) was discovered. In the first two, lowland survey blocks of the UTP, a survey of 83 sq km was completed at an intensity of 10.0 person-days per sq km; 196 prehistoric sites (comprising 425 components) were discovered, almost all of them multi-period.

I shall make no attempt to make direct comparisons between these data sets, not because this is not possible but because the purpose of the presentation is a methodological analysis of the relationship between CPD and settlements. I propose that three questions with some social significance may be answerable with reference to survey data:

(1) what can survey archaeology tell us about the long-term sequence of sites and monuments in a given region ?
(2) what can survey archaeology tell us about the regional sites-and-monuments profile along the nucleation – dispersion continuum ?
(3) what kind of a systematic relationship exists between pots and people in settlement and demographic terms?

SITES AND MONUMENTS IN A LONG-TERM REGIONAL SEQUENCE

The importance of establishing an accurate long-term sequence of site and monument classes relates to the proposition that significant places – sites and monuments – contain within them a core of what is most important for the social reproduction of the group, the mechanism through which they define their community's place in time and space, especially in relation to their past. Given that the strategies of social reproduction will be reflexively related to the form of the site or monument, it follows that changes in the form of sites and monuments should be related to changes in the underlying ideological strategy of the group. In circumstances where social change is possible, or desirable for part of the group, but in conflict with traditional group ideology, the question of how to renegotiate social reproduction is of particular significance. A familiar pattern of social reproduction concerns the use of opposition to a traditional mode in order to formulate and clarify new principles of social reproduction. In this way, a cycle of ideological strategies may be set up, based on the establishment of difference from the past, which constitutes itself through spatial strategies in relation to re-use of previous monuments, abandonment or continuity of occupation.

Before the advent of intensive, systematic survey, the constituent parts of a long-term regional sequence tended to be defined through a potent mix of biased grab samples and *ideés fixes*. Monument classes (i.e., classes of up-standing remains of earth, stone or both) tended to be discovered more frequently than other classes of sites (i.e. groups of surface artifact scatters without upstanding remains) but it was also possible to miss whole monument classes.

In Dalmatia prior to the NDP, there were four *idées fixes* which justified the known sequence of sites and monuments; conveniently, one *idée fixe* characterised each ceramic period. In the Neolithic, people were believed to live in recognisably discrete localities such as nucleated settlements or caves. In the Copper Age, the mobility of the Indo-European pastoralists was held to explain the scarcely visible remains – usually only tumuli. Too mobile to leave permanent traces of settlement, the Bronze Age Indo-European pastoralists were also often regarded as leaving little but mortuary remains – burials under tumuli. And, in the Iron Age, the concentration of the whole population in defensive hilltop sites was interpreted as a reflection of the preoccupation of increasingly ranked societies in competition with each other or as a response to outside threats.

These *idées fixes* were sufficient to direct unsystematic and/or biased surveys to selected sectors of the terrain, where sites and monuments were found to support the status quo. Consequently, key elements of the long-term sequence were missed. For the Neolithic, small settlements were neglected and settlements buried under lowland alluviation or colluviation were not sought. In the Copper Age, settlements of all kinds were in short supply. In the Bronze Age, drystone constructions of all kinds were overlooked, principally enclosed sites, delineating walls (or linear features), field systems and field clearance cairns; in addition, unenclosed settlements were rarely noted. Finally, in the Iron Age, a series of lowland farms and small enclosures was neglected.

The discovery of all of these unsuspected elements of the long-term sequence through intensive, systematic survey meant a transformation of the regional prehistoric sequence with several important implications. First, a richer and more varied suite of site and monument classes provided a more accurate record of the diversity of long-term landscape transformations. For example, for the Bronze Age, it was possible not merely to define the mortuary domain but also to characterise the domestic arena and relate it to the mortuary sphere. Secondly, as the cumulative effect of monument construction from the Bronze Age onwards became clear, so it became possible to interpret monument construction in any one phase as a response to the pre-existing drystone architecture of past generations. And, finally, the distribution of the totality of site and monument classes gave an impression of relative intensity of land use across extremely coarse time frames. On this last point, it is important to record that, on the basis of

current surface survey CPD, it is possible to subdivide only the Neolithic (into Early, Middle and Late phases), leaving six periods of over a millennium (these three, plus the Copper Age, Bronze Age and Iron Age) as temporal units.

The discovery of such a wide range of site and monument classes was possible only because of the low intensity of land use in many parts of the Dalmatian lowlands and uplands. The gradual but long-term rural depopulation of the east Adriatic lowlands since the 1920s is well-documented (Babić, 1984; Pounds, 1969); its effect on the conservation of the archaeological record is perhaps underestimated. In the Zadar lowlands, it is not feasible to identify a 'Zone of Destruction' in opposition to a 'Zone of Preservation', terms used by Taylor (1971) in the British context, since Neolithic settlement traces are still well-preserved in the lowlands because of the low intensity of farming. The comparative rarity of terracing in the Dalmatian karst has led to the preservation of much valuable evidence for drystone constructions, which in many parts of Italy or Southern France would probably have been damaged or destroyed through terracing and/or viticulture.

One archaeological problem that cannot be underestimated is the difficulty in dating drystone features without excavation. Clearly, any artifactual discard remaining on the surface of a drystone feature is as likely to indicate a *terminus ante quem* than a date of construction. The gross pattern found in the Zadar plain was, however, unequivocal: Iron Age pottery was found 'in association' with no linear features and very few clearance cairns, both of which tended to have surface finds of Bronze Age or Roman sherds. In addition, in the three cases where surface 'associations' of Bronze Age pottery with enclosures or linear features were tested by trial excavation, the fill of the features contained Bronze Age sherds (for the possible significance of this, see Chapman and Shiel, 1993: 95–97). The conclusion drawn is that the amount of effort invested in boundaries in the Bronze Age and Roman periods was much higher than in the Iron Age; the subsistence implications are more complex.

Hence, there is considerable potential for intensive, systematic survey to recover the traces of a wide range – perhaps even close to the total spread – of site and monument classes in a given survey region, given good preservation of the archaeological record in both upland and lowland zones.

In the second study region – the Great Hungarian plain – the conditions of preservation are very different because of the intensive agricultural regimes of the post-war socialist era. After the extensive agricultural conditions during the Ottoman occupation (AD 1526–1741), the drier parts of the Great Plain were subject to intensive agriculture, whilst the drainage of the Tisza and its tributaries from the eighteenth century onwards led to great increases in the cultivable area. Post-war collectivisation led to some of the most intensive, and most archaeologically damaging, cultivation regimes in eastern Europe.

The Hungarian Archaeological Topography project was introduced in the early 1960s by the MTA Institute of Archaeology as a nation-wide programme of field survey, whose aim was the recovery of a complete settlement record for the whole of the country before further destruction by intensive agriculture (Laszlovszky and Siklodi, 1990). The Topographic volumes for the Hungarian Plain record a relatively small number of prehistoric site and monument classes, comprising: surface artifact scatters of varying size and complexity, which are held to represent flat settlement sites; and three monument types – the domestic tell, the lowland fortified site and the mortuary barrow. It should be recorded that the UTP has not discovered any new site- or monument-classes to add to the well-established sequence in the Plain; rather, systematic attempts to locate settlement residues distant from the known favoured palaeo-channel locations has brought an awareness of interfluvial and floodplain settlement at a commendably early date in the Neolithic (cf. Gillings, 1995). It is also important to note that the ceramic dating of the prehistoric period is more precise than in Dalmatia, with the definition of some 12 periods of average 500 years' duration – each with type-fossil sherds of varying visibility and/or frequency. However, the same problems with the tyranny of typology apply to the Hungarian sequence, even though the chronological divisions are more refined than in Dalmatia.

The main technique whereby new site and monument classes are being discovered in the Hungarian Plain is aerial reconnaissance. Even the relatively short flying trips made by the late Professor St. Joseph and Otto Braasch over the Plain in 1992, 1993 and 1994 yielded significant evidence of a mass of hitherto undiscovered enclosures and later ditched settlement sites[2]. The important general point about these sites is their large size and marked complexity. Not only have sites more than 1 km in length been recorded along terrace edges but complex inter-cutting ditch systems on other sites suggest multi-period enclosures. This evidence is quite consistent with the field-walking evidence of a high frequency of multi-period occupations. Since almost all of the aerial reconnaissance data remain unpublished, it is difficult as yet to integrate the results into anything but a rather generalised picture of the regional sequence.

The picture that emerges from eastern Hungary is a complex sequence of the take-up and abandonment of different site and monument classes, often in apparent contrast to what was utilised immediately before (Figure 5.2). Proposed explanations for this cyclical patterning of use, abandonment and re-use are published elsewhere (Chapman, 1994, 1995).

Thus, the question posed about the ability of survey archaeology to inform us about long-term sequences of site and monument classes can be answered positively, accepting the constraints on the preservation of the archaeological record. Two kinds of information can be produced: a general regional sequence, which can be used

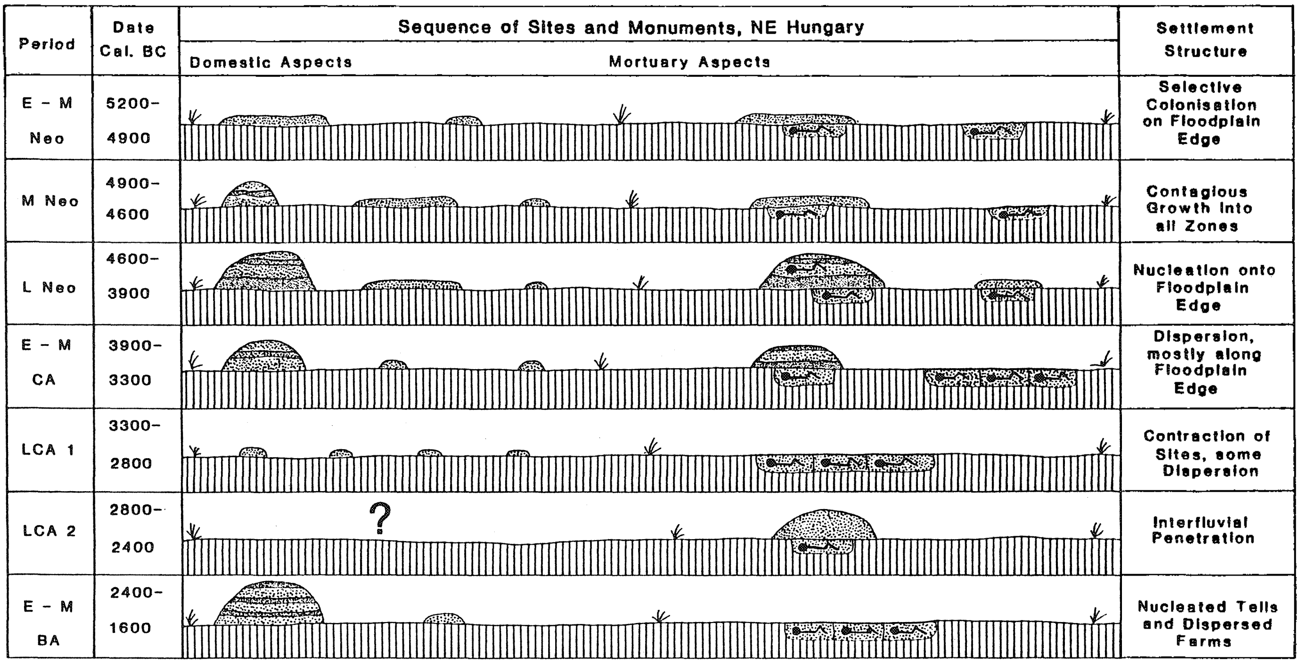

Figure 5.2 Long-term sequence of sites and monuments in North Eastern Hungary.

as an idealised control on local variations; and the local site and monument configurations, with information about actual social and economic relations at a given time. Both types of data are important for an understanding of the regional pattern.

NUCLEATION, DISPERSION AND DEMOGRAPHY

The nucleation – dispersion continuum represents a measure of the relative sizes of settlements through the long-term sequence of sites and monuments. There are many interesting theoretical reasons for the preferences which communities express for their position on the continuum, which in prehistory we can take as stretching from the individual farmstead to the urban centre (Chapman, 1988a). My second question concerns what survey archaeology can tell us about the regional sites-and-monuments profile along the nucleation – dispersion continuum.

Ceramic proxy-data (CPD) are the most frequent method of defining the size of a settlement within a specific phase dated by the given ceramic-based chronology. Since there is no direct fieldwalking measure of site population density other than by assessing the amount of discard in a standard area, further proxy-data are necessary. These are generally provided by ethnographic data in the form of population density estimates per hectare (e.g., Ammerman *et al.*, 1976; Postgate, 1994; Sumner, 1975, 1989), a calculation that increases the standard error by a factor of two. Such a technique could be said to make use of the so-called 'factoid', the assumption that a previous possible interpretation is actually true for the next stage in the argument. It could be argued that the collation of a number of individual site population densities to provide a calculation for a regional population estimate is based on two levels of factoids and is best avoided as an example of spurious statistical precision.

In his introduction, Sbonias (this volume) reluctantly accepts that there is no direct relationship between settlement density and population size. This formulation is merely the inter-site version of a wider – perhaps the core – problem of survey interpretation: the palimpsest phenomenon. There are two versions of this problem. The intra-site problem is whether a larger-than-average number of sherds in a surface scatter indicates a more intensive deposition (the discard option), a higher site population (the nucleation option) or a longer occupation (the sequential option). This version is of direct concern to whether or not a site's position on the nucleation – dispersion continuum can be defined. Paraphrasing Sbonias, the inter-site version concerns the number and size of coeval occupations within an externally-defined chronological period. This version is of particular concern to survey archaeologists, one of whose principal achievements has been the location of increasingly large numbers of small sites across the landscape. Currently, there is no known technique for the estimation of the number of small prehistoric sites 'missed' by intensive field survey.

The palimpsest problem is of concern in the Dalmatian study region mainly because of the long time periods comprising the chronological framework. The paucity of Neolithic and Copper Age sites over a period of 3,000 – 3,500 calendar years and their generally small size indicates

a small population almost all occupying dispersed sites, presumably individual farmsteads. Contrary to the pattern in other parts of the Dalmatian coast, there is no obvious tendency towards nucleation in Late Neolithic sites in the Zadar lowlands.

In the Bronze Age, covering some 1,300 calendar years, it is currently impossible to assess the contemporaneity of even enclosed sites and field clearance cairns in the same segment of landscape, let alone settlement clusters across the survey block. In the case of the linear cairnfield on the Mataci ridge, both Bronze Age and Iron Age pottery have been discarded on the surface of some of the cairns, the smaller enclosures at the East end have been dated to the Bronze Age and the large enclosure and hillfort at the West end to the Iron Age. These three strands of dating could mean a continuous expansion of the cemetery from East to West or two distinct phases of use separated by almost 2,000 years. By the same token, the surface artifact dating of Iron Age hillforts is insufficiently precise to adjudicate between the two principal theories to account for the development of major pre-Roman hillforts: Čače's (1985) hypothesis of a phase of smaller hillforts in the early Iron Age replaced by larger, more nucleated hillforts after 400 BC cal, and the NDP's hypothesis of a range of smaller early hillforts, some of which remain in use alongside the larger hillforts of the Late Iron Age (Chapman *et al.*, 1996).

In the Hungarian Plain, the larger areas of the survey blocks and the immeasurably richer settlement record, preserved despite agricultural threats, allow the creation of a more quantitative picture of changing site configurations. The diachronic pattern of shifts in settlement numbers is by now fairly well established for the Alföld Plain (Figure 5.3), whether based on the MTA Topographical Programme's surveys in adjacent parishes of County Békés (Ecsedy *et al.*, 1982; Jankovich *et al.*, 1989; Sherratt, 1982)

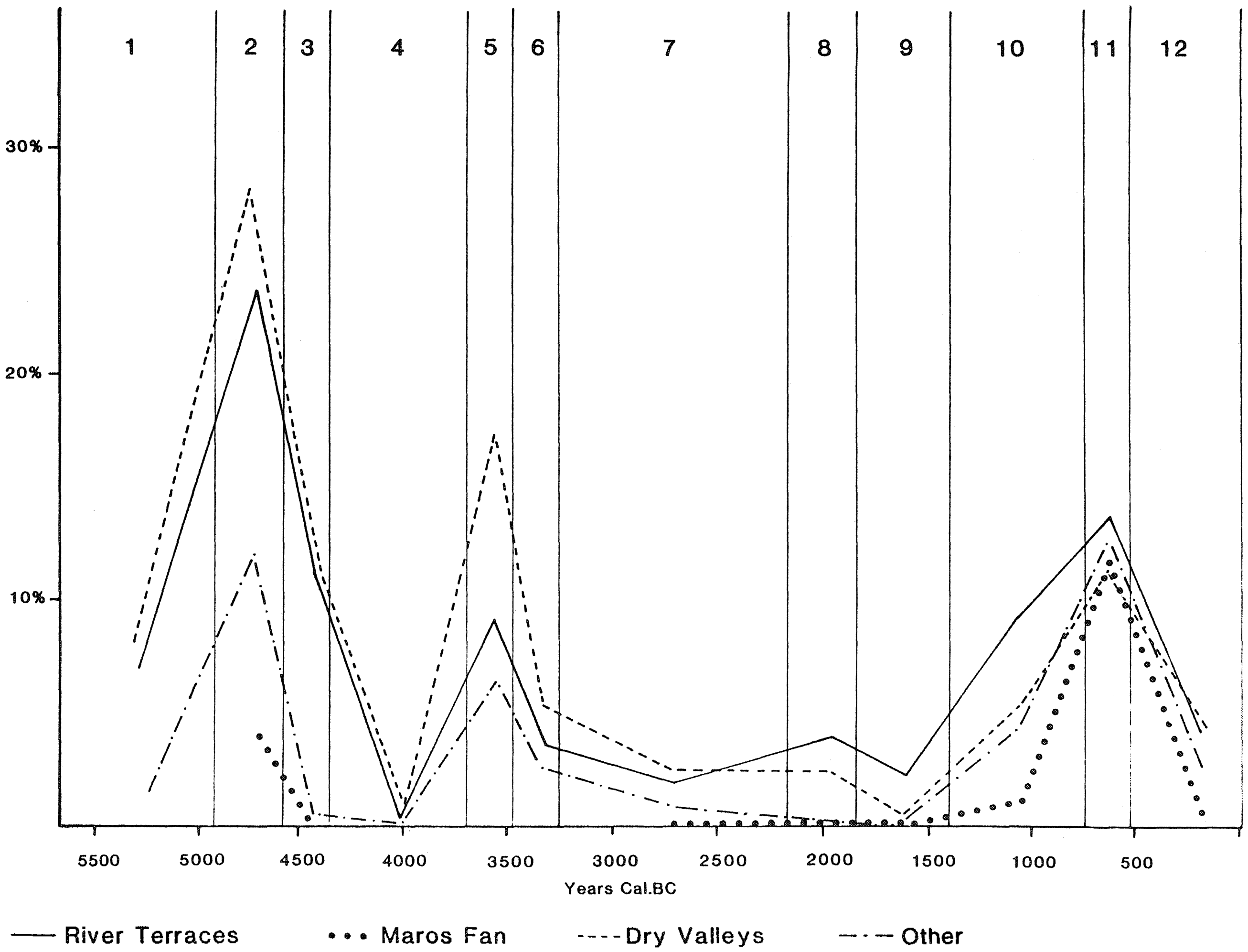

Figure 5.3. Mean Ratio of occupations per century: Diachronic trends in site numbers per century in County Békés II, eastern Hungary. Periods: 1 – Early Neolithic; 2 – Early Middle Neolithic; 3 – Late Middle Neolithic; 4 – Late Neolithic; 5 – Early Copper Age; 6 – Middle Copper Age; 7 – Late Copper Age; 8 – Early Bronze Age; 9 – Middle Bronze Age; 10 – Late Bronze Age; 11 – Early Iron Age; 12 – Late Iron Age.

or based on the smaller-scale but more intensive UTP surveys on the Northern margins of the Plain (Chapman and Laszlovszky, 1992, 1993).

The traditional cultural and demographic interpretation of this sequence follows the equation of cultural complexity with nucleated settlement, often on tells, in contrast to the dispersed and shifting settlement and low degree of cultural innovation of intervening periods. The reflectionist interpretation of this pattern has some parallels in the long-term cycles of nucleation and dispersion which Bintliff (1982, 1984) has identified in Greece. The high peaks of the Hungarian sequence come in the Late Neolithic and the Early – Middle Bronze Age, with major nucleation of populations on the tells of the Plain (Raczky, 1987; Meier-Arendt, 1992). Makkay has made a population estimate for the Late Neolithic tell of Szegvár-Tüzköves of almost 1,200 people (Makkay, 1982: 131–133) – surely an exaggeration based on maximum economic use of the tell territory! Before the Late Neolithic peak, the Early and Middle Neolithic record comprises large numbers of smaller sites until the later phase of the Middle Neolithic, which shows some sign of increasing nucleation. The Copper Age lies uneasily between the great peaks of Neolithic and Bronze Age tell-formation, its obvious technological advances in copper metallurgy seemingly at odds with the dispersed and temporary settlement record. After the end of tell living in the Middle Bronze Age, dispersion into what are presumed to be farmsteads occurs in the Late Bronze Age, despite the structured deposition of large quantities of fine metalwork. Even less settlement evidence is attested in the Iron Age, a time of relative cultural stagnation in the Alföld Plain.

Such a complex and seemingly well-supported narrative is, however, based on several flawed assumptions. For our present purposes, the most important point is that it takes no account of the palimpsest problem at either the intra- or the inter-site level. Let us first investigate the implications for the earliest farming groups.

The Körös settlements of the 6th Millennium CAL BC provide a classic example of the palimpsest problem. Their size ranges from 50 x 50 m scatters to long thin sites more than 1 km in length (Ecsedy, 1972; Makkay, 1992). In smaller sites such as Szarvas 23, excavations of nine pits have produced typological and 14-C evidence for occupations stretching across an entire millennium, with small occupation foci of a house or at most two dating to each of the early, middle and latest phases of the Körös culture (Makkay, 1981; Chapman, in press). As part of the MTA's Microregional Programme, a total excavation of a small Körös site was mounted at Endrod 119 and two phases of a single-household settlement were identified in an occupation of no longer than a century (Makkay, 1992). It is most likely that the long thin Körös sites represent successive occupations along active river channels, with only a fraction of the site utilised in any given decade (Sherratt, 1983). The tendency for a re-

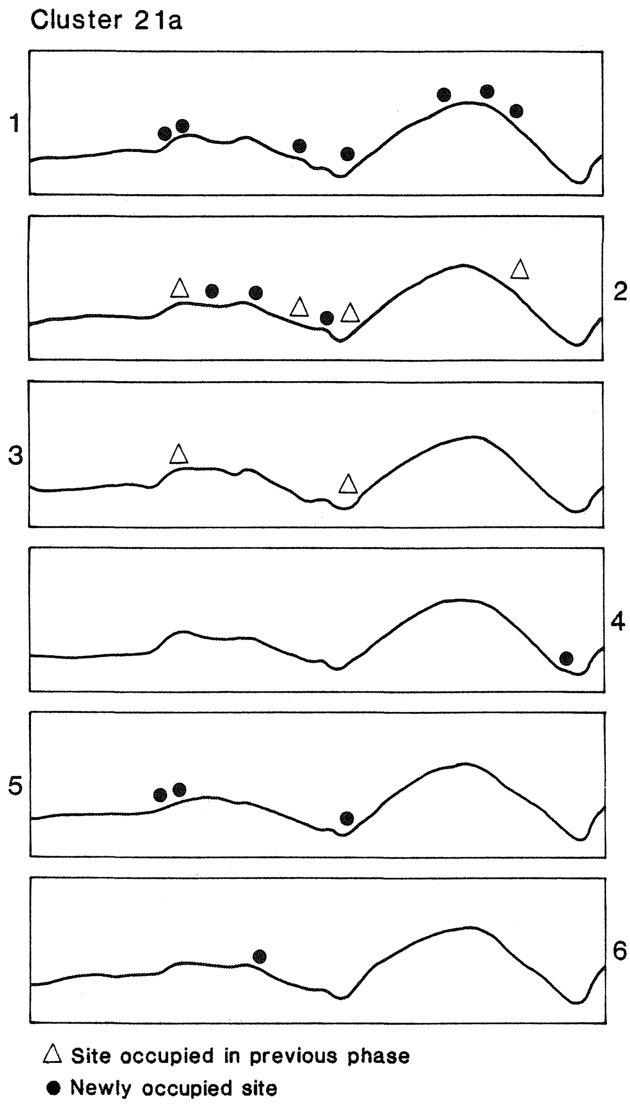

Figure 5.4 Distribution of Neolithic and Copper Age sites in clusters, County Békés II survey data. Periods 1 – 6 as in caption for Figure 5.3.

flectionist interpretation to exaggerate the site size of Körös settlements is manifest from these examples. One alternative reading of the ceramic proxy-data is that small Körös sites represent one or two short occupations by one-household groups (e.g., Endröd 119), larger sites show several phases of re-occupation by single households or dual household groups (e.g., Szarvas 23) and that the largest sites indicate multiple re-occupations by larger numbers of households (e.g., Endröd 35).

At the inter-site level, the most striking pattern found in the County Békés survey is the clustering of 80 % of the sites into 20 % of the landscape. These clusters of sites are often long-lived, showing continuous use of a small segment of a river valley for several millennia (Figure 5.4). One demographic model for the clusters is that all the Körös sites in each cluster represent suc-

cessive re-occupations of a single kin group of no more than a few households. On the current evidence, this minimalist model would be hard to falsify and would lead to a drastic re-appraisal of the settlement patterns of the Hungarian Plain.

One such exercise in demographic modelling would involve the comparison of site numbers in four successive phases of the Neolithic in the County Békés II survey area (Table 5.1 and Figure 5.5).

Period	Duration (14-C years)	Number of Sites
Early Neolithic	1000	144
Early Middle Neolithic	200	249
Late Middle Neolithic	200	62
Late Neolithic	700	11
Early Copper Age	200	77
Middle Copper Age	400	34

Table 5.1. Neolithic sites occupied by period, County Békés II.

According to the traditional interpretation, the huge swings in site numbers in these phases would reflect not only changes in site dispersion and nucleation but also real increases and falls in population. Yet the huge drop in site numbers in the Late Neolithic fits poorly with the notion of a cultural climax, given the existence of only one major Late Neolithic tell (Szarvas – Kóvacs-halom) and a small group of 'satellite' farmsteads. An alternative possibility, yet to be carefully evaluated, is that the Late Neolithic 'climax' was a period of falling population whose cultural diversity was the product of a divided society with all the social and economic problems generated by living in a densely nucleated community.

If the alternative model of single kin group occupation of each site cluster is applied to the County Békés II Neolithic data, the results are quite striking (see Table 5.2).

The use of the number of occupied clusters as a proxy-measure of population avoids the skewing produced by the site number statistics, perhaps because it defines an appropriate unit of analysis for more mobile populations.

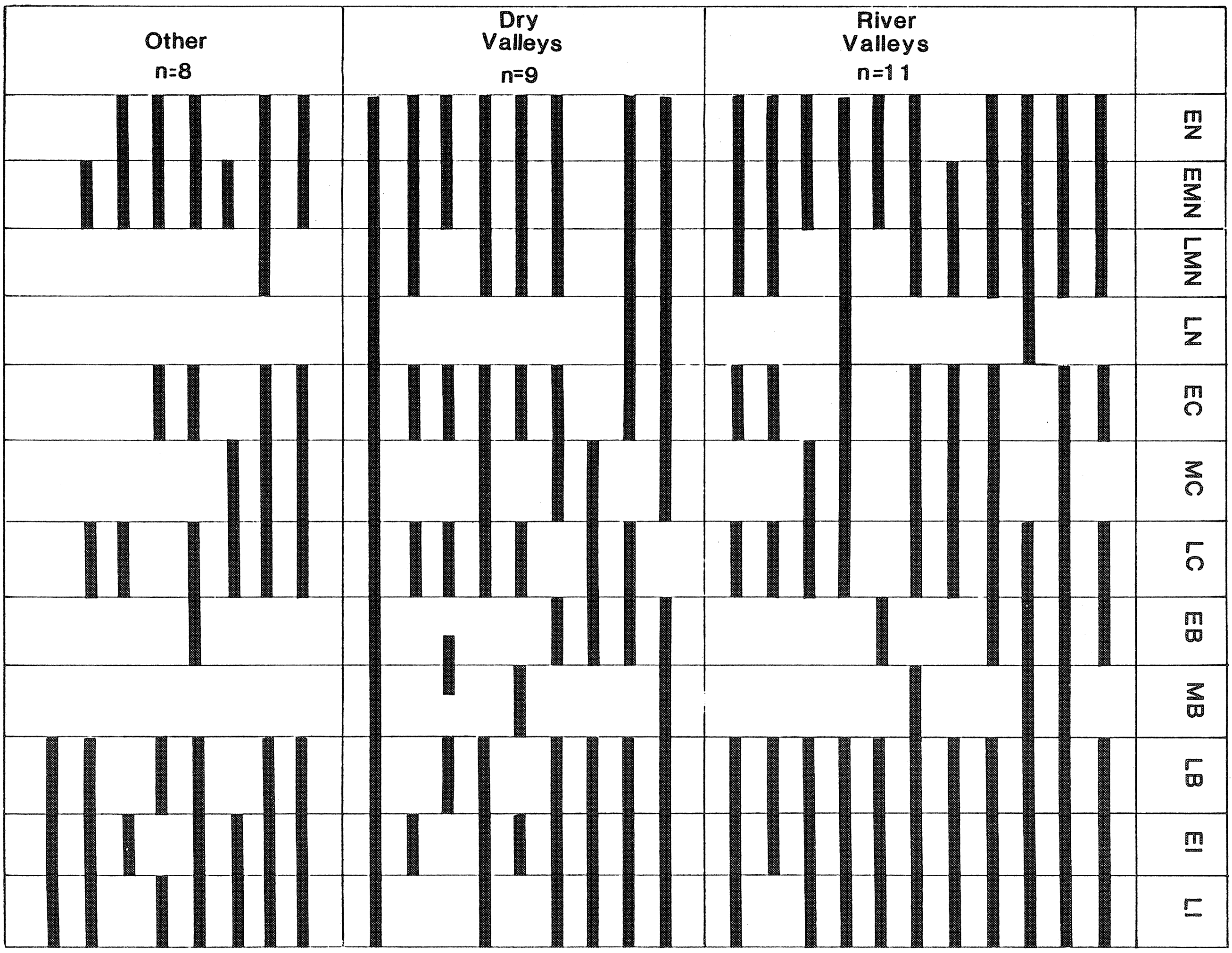

Figure 5.5 Settlement continuity by clusters, County Békés II data. Periods as in caption for Figure 5.3.

Period *	EN	EMN	LMN	LN	ECA	MCA
Sites Occupied	144	249	62	11	77	34
Clusters Occupied	23	26	16	4	19	13
Site:Cluster Ratio	6.3:1	9.6:1	3.9:1	2.8:1	4:1	2.6:1

* Key to Periods as in caption for Figure 5.3.

Table 5.2. Site and clusters occupied, County Békés.

If these proxy-data are acceptable, they mean a more stable occupation of the central part of the Plain, except in the Late Neolithic and the Middle Copper Age. While Sherratt (1983) has argued for a Middle Copper Age preference for edge-of-the Plain site locations, this still leaves the Late Neolithic as a demographic sink, seemingly abandoning large segments of the landscape, segments whose continuing suitability for occupation is demonstrated in the ensuing Early Copper Age.

The survey data from the Upper Tisza Project derives from a far smaller area than the County Békés II data set, yet is beset by similar problems. In North East Hungary,

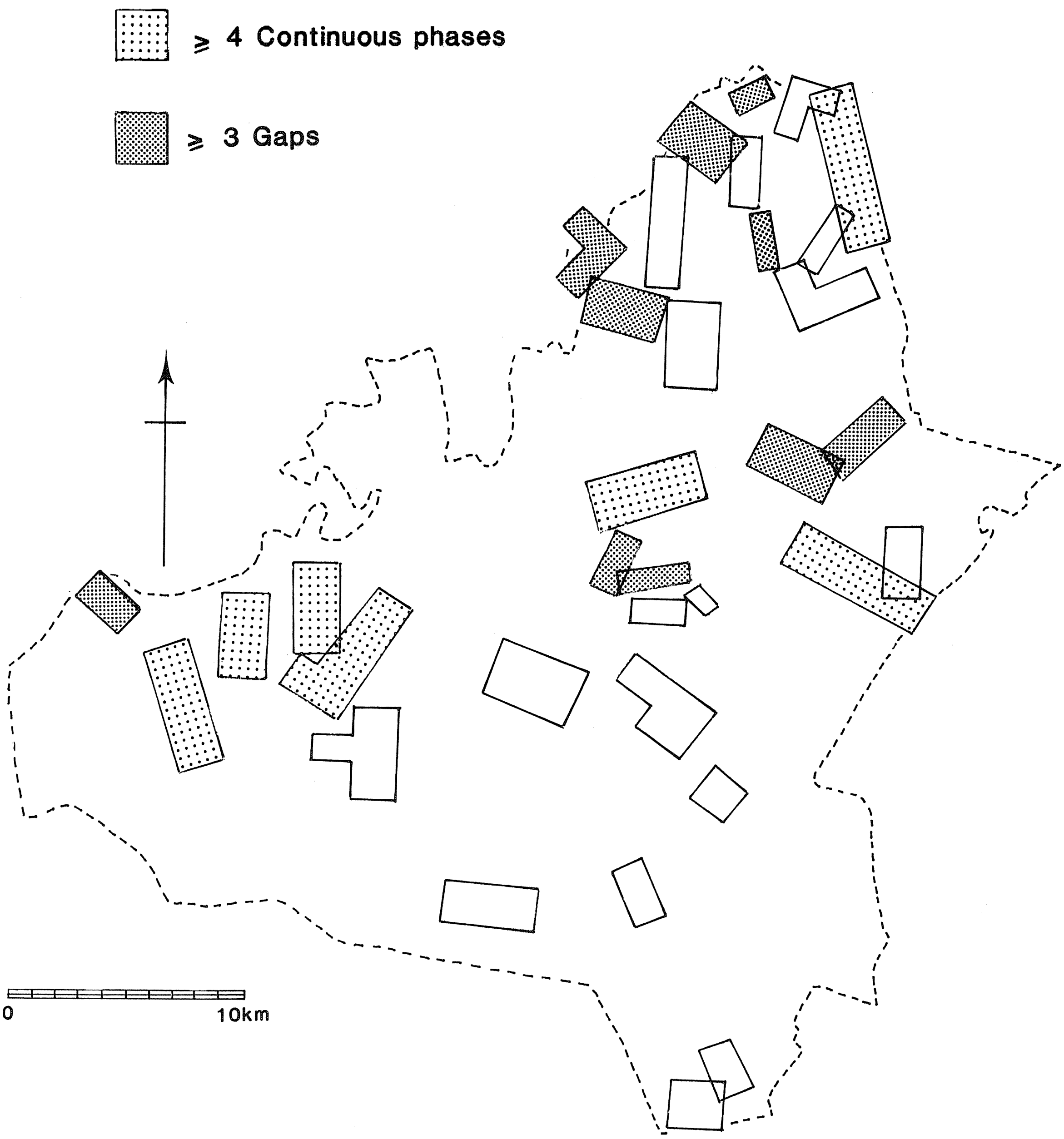

Figure 5.6 Settlement distributions by cluster, County Békés II data. Code: densely stippled – clusters with 4 or more phases of continuous occupation; moderately stippled – clusters with 3 or more gaps in continuity of occupation.

at the very limits of the Eurasian distribution of tells, two contrasting patterns are found in the two lowland survey blocks. In the Polgár Block, where the northernmost cluster of tells occurs, there is a striking repetition of the site clusters seen in Co. Békés, with a range of floodplain edge locations preferentially selected from the total available area. When the few tells known in the Polgár block emerge, they are located not only in previously settled areas but in long settled areas – especially the Csöszhalom tell, in its cluster of over a dozen, presumably non-contemporary, Middle Neolithic flat sites. Here the Early-Middle Bronze Age tells are also founded in areas of Late Copper Age settlement and/or kurgan barrow construction.

In the Bodrogköz Block, where only one tell is known (Bodrogzsádany) together with large flat sites, the pattern of local site clusters is not so strong; instead, a major feature is the frequent re-occupation of the same site, often over many millennia. The surface scatter at Rakamaz 001, covering 25 ha, betokens 12 phases of prehistoric re-occupation, mostly over a relatively small part of the total area. The total number of Neolithic – Bronze Age sites is far smaller than in the Polgár block, signifying either lessened site mobility or a smaller population size in the Bodrogköz block or conceivably both.

The two conclusions which may be drawn from these analyses of the Eastern Hungarian data are that: (1) survey archaeologists are seriously under-estimating group mobility in agro-pastoral societies; and (2) *pari passu*, survey archaeologists are seriously over-estimating the contemporaneity of occupation features as defined by ceramic proxy-data. The combined implication of this is that we cannnot be so sure as we were that long-term permanent village settlement was the norm for most of Hungarian prehistory; neither can we be so sure of the chronological integrity of many other, smaller sites. These conclusions have a serious impact on our confidence in demographic modelling, which from a Hungarian as much as a Dalmatian perspective, takes on the attributes of an art rather than a science. But they also mean that the location of sites on the nucleation-dispersion continuum is somewhat harder than has hitherto been assumed. The relationship between forager and farmer mobility is discussed more extensively by Zvelebil (1993), who reminds us that the mobility of farming populations may well not have declined relative to that of foragers.

POTS, SETTLEMENTS AND PEOPLE

We may now return, finally, to the third question which we posed: what kind of a systematic relationship exists between pots and people in settlement and demographic terms ? It is my belief that any survey archaeologist confronted with the tortuous road to demographic reconstruction would be sorely tempted to answer; 'none at all', especially not in the prehistoric period. Fortunately for survey optimists, that still leaves two other potentially answerable questions for a realistic research agenda. It is an agenda which merits much research attention in future years.

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NOTES

1 The Upper Tisza Project is an Anglo-Hungarian research project designed to define and explain changes in the physical and social environment of the Upper Tisza basin in North East Hungary over the last 10,000 years.

2 The Institute of Archaeology, Eötvös Loránd University, Budapest has created a database of all the aerial photographs taken on recent sorties over Hungary. Many of these oblique photographs have now been transcribed as plans in AUTOCAD (pers. comm., P. Raczky).

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6. An Attempt at the Demographic Interpretation of Long-term Settlement Processes in the Prehistory of Slovenia. The Case of the 'Archaeological Map of Slovenia'

Predrag Novaković

THE SLOVENIAN GEOGRAPHIC MOSAIC

Slovenia is a country of c. 20,000 km^2 situated between the northeastern Adriatic, southeastern Alps, northwestern Balkans and western Pannonian Basin. Although it is a relatively very small country, now inhabited by c.2 million people, it is geomorphologically and ecologically composed of numerous very distinctive and heterogeneous landscape types. Highly differential geology, topography, vegetation cover, climate, and consequently, to a certain extent differential historical and cultural processes which marked the history of Central and Southeastern Europe, meet at this point.

The territory of Slovenia is located at the interface of two major mountain ridges in this part of Europe: the eastern Alps and northeastern Dinaric Alps; and two major plains: the Po valley and the Pannonian Basin. Such a position determined to a great extent the area of Slovenia as a transitional zone between these major regions. According to Gams (1991), there are five main geographical constants that determine long-term social, historical and cultural processes in this area:

a) highly dissected mountain relief,
b) the interface of the four main natural geographic regions: alpine, dinaric, sub-pannonian and sub-mediterranean,
c) the position at the southeastern edge of the Alps at the lowest passes between Southern and Central Europe,
d) the location at the southeastern European contact zone between Central and mediterranean Europe,
e) relatively unfavourable conditions for agriculture.

To this we can also add another important feature of Slovenian geography, namely, the very short distances between major geographical regions.

Starting from the southwest, we can follow over a distance of no more than 200 km, the transition from the mediterranean and alpine landscapes, into the sub-pannonian lowlands. Generally, Slovenia is according to Ilešič (1979) divided into five main regions (Figure 6.1):

1. The alpine region, 11% of the total territory, situated in the northwest. It is characterized by very high mountains and hills that frequently exceed 2,000 m. Mountain and hill ridges are cut by narrow river valleys and some higher plains which are normally 500–1000 m below the mountain peaks, and are actually the only areas suitable for agriculture and settlement. Slovenia is the third country in Europe, after Austria and Switzerland, regarding the proportion of alpine landscapes within its territory.
2. The sub-alpine region, 32.5% of the total territory. This region extends into Central Slovenia and is the most common landscape type. The topography is mostly composed of medium high hills and ridges (the average altitude between 200–500 m), major river valleys and alluvial plains (such as the Ljubljana and Celje Basins), that offer relatively favourable agricultural conditions.
3. The dinaric region, 25% of the total territory, located in southern central and southeastern Slovenia. The topography is mostly marked by various karstic plateaux, hills and ridges, dissected by karstic depressions (poljes) and few river valleys. On average, the plateaux are over 400 m in height and are covered with dense forests. Due to the unfavourable conditions for agriculture (lack of water, permeable underlying geology, high altitudes, etc.) this region is very rarely settled. The only significant concentration of population is on some lower plateaux, which offer better conditions for soil preservation, and in some larger karstic depressions.
4. The Littoral (sub-mediterranean) region, 7.8% of the total territory, in southwestern Slovenia, in the northern Adriatic. The relief is mostly composed of lower (less than 300 m in height) Eocene flysch hills and smaller river valleys with a few larger alluvial areas at their mouths. There are also some karstic plateaux, but they never exceed 400 m in height. Due to the mediterranean climate and favourable geology, this region has relatively good agricultural

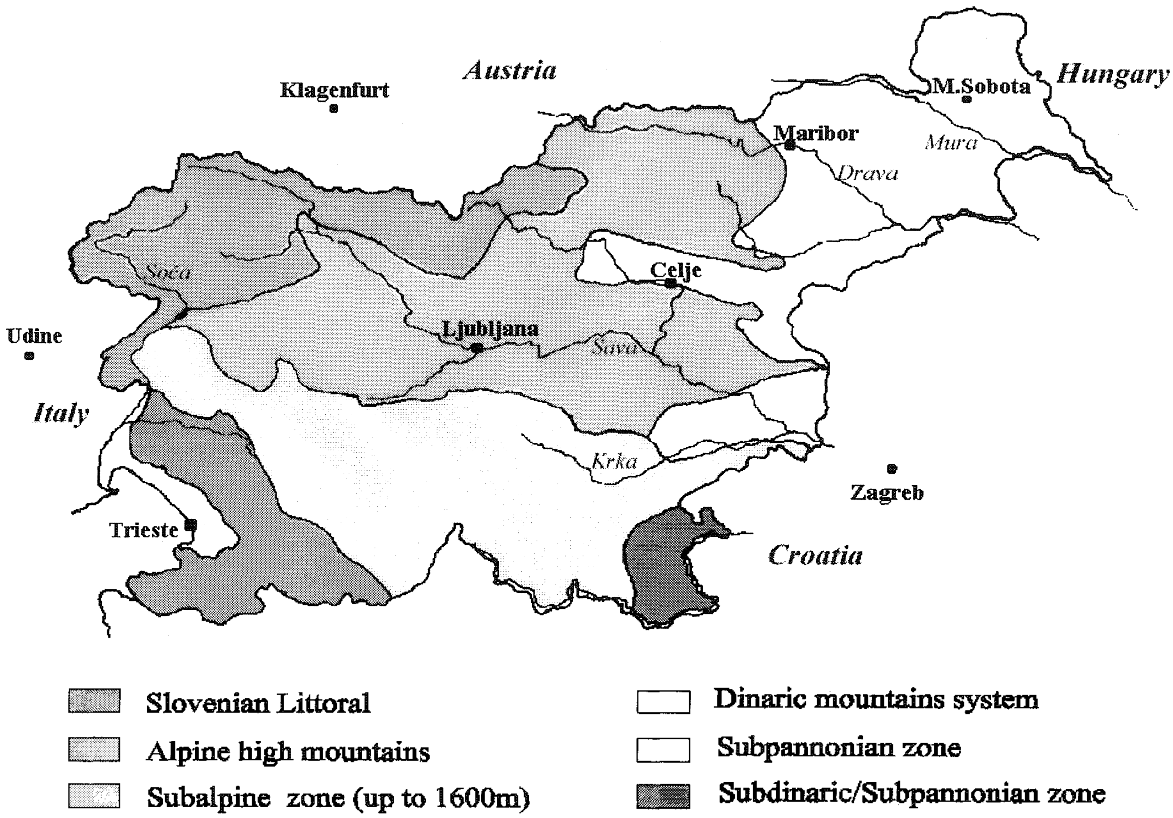


Figure 6.1. Physiographic regions of Slovenia (after GAMS, 1992: 12).

potential that resulted in higher population concentrations.

5. The sub-pannonian region, 22% of the total territory. It is situated in northeastern and eastern Slovenia and characterized by small hills and larger lowland areas along the rivers Save, Drave and Mura. The Tertiary hills, on average, do not exceed 200 m. Most of the land is composed of fluvio-glacial basins and valleys and offers very favourable conditions for agriculture. Today, for example, one third of the population lives in this area. The ratio was even higher before the major urban centres, Ljubljana and Maribor, arose through immigration in this century.

Regional and topographic diversity is also visible in climatic and vegetational zoning. The prevailing climate in the western part is sub-mediterranean (Csa after Köppen's *Handbuch der Klimatologie*, Berlin 1936) and alpine in the highlands, while the eastern part is under the influence of the boreal climate with warm summers (Dfb after Köppen [Kunaver, 1995: 5]). The average rainfall in the west is c. 2000 mm per year (with a 3,500 mm peak in the Julian Alps) and gradually falls towards the east, where at the very fringes it reaches a minimum of 800 mm (Gams, 1992: 15). Although there is relatively abundant rainfall, which produces well watered soils and enough water in rivers, the specific and high runoffs diminish soil fertility. Soils are mostly shallow and acidic on steeper slopes and in karstic areas (rendzinas, rankers and brown soils) whilst gley soils prevail in the plains. The proportion of cultivated land today is 12%, whilst more than 50% of the whole country is under forests (Gams, 1992: 15).

A frequently encountered phenomenon in numerous valleys and karstic depressions is temperature inversion, which additionally diminishes land fertility. Generally, the areas 300 m above valley bottoms are considered as a so called 'thermal band' and normally have better temperature conditions for cropping (Kunaver, 1995: 15).

Such regional diversity also resulted in six major phytogeogeographic zones: alpine, dinaric, sub-mediterranean, sub-pannonian, pre-dinaric and pre-alpine (Kunaver, 1995: 16). The relative abundance of natural resources and their diversity is also visible in the more than average number of floral and faunal species. For instance, there are 113 zoological taxa per 10,000 sqm. Furthermore, besides major eco-zones offering differential potential for agriculture, the topography also plays a very distinctive role. In Tables 6.1 and 6.2 population distribution according to the classes of elevation and slope gradient is demonstrated. The slope gradient with the densest population was 6–11 degrees (82 persons/sq km), the second is 0–5 degrees class (69/sq km), and the third the class of 12–19 degrees (64/sq km).

It is no coincidence that the highly intensive political and cultural history of Slovenia from the past to modern times was to a great extent also influenced by geographic

Altitude class	% of territory	% of population 1869	1931	1991
0–300 m	26,7	44,1	50,7	52,5
300–600m	38,4	44,4	39,9	43,3
600–800m	15,4	19,4	7,4	3,2
above 800 m	9,0	2,5	2,2	0,8

Table 6.1. Population distribution according to the classes of elevation (Perko, 1995:9–10).

Slope gradient classes	% of territory	% of settlements	% of population
0–5°	30,4	24,0	33,6
6–11°	21,8	35,4	32,8
12–19°	22,4	32,1	26,1
20–29°	15,9	8,2	7,3

Table 6.2. Population distribution in 1869 according to the slope gradients (Perko, 1995: 10).

factors. The transitional position of Slovenia, especially the low passes across the Dinaric ridge (the Postojna corridor), was strategically extremely important for the control of traffic between the Adriatic (Mediterranean) and Eastern Central Europe throughout history. On the other hand, eastern and southeastern parts of Slovenia are much more open towards the Pannonian Basin and the Balkans. Actually, it is this latter direction that played an important role in physical and cultural diffusions in the past, from the Neolithic to the arrival of the Slavs. Indeed, the only major cultural and population migration coming from the west, was that of the Romans, who incorporated the territory of Slovenia into their Empire in the period between the last decades of the 1st century BC and the first decades of the 1st century AD.

Generally, it is possible to distinguish between two major zones with differential cultural and historical developments within the Slovenian past: the western zone (especially the southwest) which was influenced or was a part of the Adriatic (mediterranean) cultural milieu, and continental Slovenia which was much more influenced by the processes in the southeastern Alps, the Pannonian Basin and the Balkans. Furthermore, the continental part itself, due to geographical diversity and its historic development, can be further divided into alpine, central continental (sub-alpine and dinaric) and sub-pannonian cultural zones, each of which require separate study.

On the other hand, the very short distances between these geographic zones and the changing rhythm of various landscapes forced the development of complementary economies, intensive contacts and the formation of political alliances within the framework of certain historical conjunctures. Hence, Slovenia, due to its high regional diversity and its interface position, can provide one of the best examples for comparative studies of the major trends and processes in much wider areas in the last five millennia.

ARCHAEOLOGICAL SURVEY IN SLOVENIA

However, the potential of such geographical conditions for archaeological studies of long-term settlement and demographic processes has not been met by developments within archaeology. Slovenian archaeology is still to a great extent rooted in a culture history approach and its studies are more site and artefact than landscape oriented.

Traditionally, archaeological survey (also termed archaeological topography) was mainly aimed at discovering new sites, to be eventually excavated. This approach, still relatively popular amongst the Central European archaeologies, stems out of a long tradition of mapping archaeological sites and monuments for their protection in the last decades of the 19th century. Slovenia has quite a long tradition of such works (see Petru, 1975: 15–19). The first archaeological map was published by P. Radics as a supplement to his *Geschichte von Krain* (Graz, 1869). Shortly after, in 1865, F. Pichler in his *Repertorium der steirischen Münzkunde I-III* (Graz) also published a map of other archaeological sites from modern north-eastern Slovenia. Later, the need for legislation and protection of sites and monuments required the publishing of another and more accurate map for Carniola (Central Slovenia). This work was carried out by A. Globočnik in 1889. The progress of such works and associated fieldwork at the end of the last century is also visible in the appearance of thematic archaeological mapping in a regional framework. Two examples well illustrate these trends: A. Premerstein and S. Rutar, *Römische Strassen und Befestigungen in Krain*, Ljubljana 1899; and C. Marchesetti, *I castellieri preistorici di Trieste e della regione Giulia*, Trieste 1903. In the period between the Two World Wars, the development of settlement studies and the need for comparative analyses required an international network and standards for publishing such maps. According to the scheme and standards of The International Association of Academies, archaeological topography in Yugoslavia became one of the most important tasks, and, amongst other things it resulted in publication of the archaeological maps of two regions in eastern Slovenia (B. Saria and J. Klemenc, *Archäologische Karte von Jugoslawien: Blatt Ptuj*, Belgrade-Zagreb 1936; B. Saria and J. Klemenc, *Archäologische Karte von Jugoslawien: Blatt Rogatec*, Zagreb 1939). Archaeological topography was also among the primary tasks in post-WW2 Yugoslav archaeology. The preparation of a new map started in 1956, but it was only in 1965 that the first register of sites was submitted to the Academy Commission. New standards also demanded changes in fieldwork. For this reason, S. Pahič (1962) published a manual of procedures and recording standards that became obligatory for all archaeologists in Slovenia. However, due to the

very different types of data, bibliographic notes and fieldwork reports accumulated in nearly 100 years of archaeological topographic efforts, the editors (the team at the Slovenian Academy of Arts and Sciences) required 10 years for publication of the first book (*Arheološka najdišča Slovenije*, further in the text quoted as ANSL), which included information on all archaeological sites known before 1965. The second phase, aimed at more detailed regional studies based mostly on recent fieldwork campaigns under the auspices of the Academy, was not so successful. Only two out of twenty archaeological regions were published completely: the Bela krajina (Dular, 1985) in southeastern Slovenia and Pomurje (Šavel, 1991) in the northeast. However, in the last few years, work on the archaeological topography of Slovenia has somewhat slowed down, also due to the introduction of new methods and techniques in survey archaeology, which require a different conceptual framework. Nevertheless, the work on site registers is still continuing at the Institute of Archaeology of the Slovenian Academy of Arts and Sciences and will be soon available as a computer record (Hvala-Tecco, 1992; Modrijan, 1994).

From the mid-80s systematic survey techniques and landscape oriented studies found their way into Slovenian archaeology. The first years were actually the period of the introduction of systematic sampling strategies, so, besides the Hvar Project (systematic survey of a Dalmatian Island in Croatia, see Bintliff and Gaffney, 1988), where a Slovenian team worked together with British colleagues from the University of Bradford, all other surveys done in Slovenia were microregional in their scale, and it is only very recently, when, pressed by extensive motorway construction, that systematic archaeological survey became more widely accepted as an important methodology applied on larger scale projects.

There is also another fact which influenced the development of survey archaeology in Slovenia. Regional diversity, natural and cultural processes and activities, which condition the preservation of the surface record, have very differential effects on on-site and off-site surface archaeology. The rescue surveys designed for the Archaeology on Slovenian Motorways Project have clearly demonstrated this problem. Even for the Roman period, which generally produced most of the surface scatters in arable land, the artefact numbers indicating sites differed greatly. It is obvious that separate methodologies and concepts will have to be developed with respect to the geographic regions.

The general philosophy and methodology of the traditional surveys were largely the same as those at the end of the last century, when such campaigns were launched by central authorities or academies. The basic concept and unit of observation was 'the site', characterised by surface remains, either structural or in the form of denser artefact scatters in a small area. The surface record was perceived as a guide to the sites worth excavating later. It was also assumed that the surface record reflects the date and the extent of the site and that potential excavation would only refine previous information (Chapman, 1989: 4).

Such an approach, virtually unchanged for decades, was further elaborated methodologically and refined in the 1920s and 1930s by German archaeologists and termed Archäologisches Landesaufnahme (Jankuhn, 1973: 391–394). Through time, this approach developed its methodology towards a more detailed prospection of smaller regions, and the inclusion of data on the natural environment. From the point of view of modern survey methodology, the Archäologisches Landesaufnahme can be described as a judgemental and site oriented strategy. The outcome of such surveys were normally various maps, with sites as dots within their natural setting (geology, geomorphology, hydrology, etc.).

ANSL (The Archaeological Map of Slovenia) is thus still the only record of a large-scale survey project. It undoubtedly originates from the *Archäologisches Landesaufnahme* tradition. It is composed of the records of sites and monuments, visited and recorded by a number of archaeologists, geographers, historians and in some cases also laymen, from the end of the 19th century to the early 1960s. The basic archaeological and recording unit is the site. Each site has a short description of its natural setting, its discovery, the person who discovered it, its chronology, basic bibliographic references, and in many cases notes on some of the most important artifacts. The precise location of the site is unfortunately not defined in any of the standard systems (e.g Gauss-Krieger coordinates or in degree/minute/second system of geographical latitude and longitude) but more contextually (e.g. 'the grave was found 200 m north of the village').

The whole area of Slovenia is divided into 20 archaeological regions and the regions itself into sectors. The chronology of the sites is defined by 8 periods: Palaeolithic, Neolithic/Eneolithic, Bronze Age (Early/Middle), Late Bronze Age (Urnfield period), Early Iron Age, Late Iron Age, Roman period, Early Mediaeval period. There are also 17 site types: settlement, settlement with cemetery, cave site, open-area Palaeolithic site, cemetery/single grave, fortress, objects/single find, hoard, coin, bridge, road, in situ milestone, transferred milestone, enclosure wall, aqueduct, quarry, Mithraeum. The other two types are: prehistoric site (undefined) and chronologically undefined site. In this way, more than 3200 entries are recorded. However, in some cases, there are two different names for the same site, so the actual number of sites is less than 3000.

ANALYSIS OF ANSL

Although ANSL represents the outcome of a respectable tradition of 100 years of topographic work in Slovenia, there are still many other issues worth studying today. If we take into account the fact that from the mid-19th

century to WW 2, only a few individuals in Slovenia can be considered as professional archaeologists, then the amount of work and survey (bibliographic and fieldwork) they undertook exceeds expectations. Furthermore, archaeological site records for Slovenia contained less than 300 sites before the 1960s. From the mid 1950s, when virtually all archaeologists in Slovenia started a systematic review of the previous publications and notes, as well as carrying out topographic surveys, they actually produced a figure of nearly 3000 new sites in less than one decade. Another important fact is that many of the sites and monuments recorded in ANSL were recorded before the dramatic and overwhelming social and economic changes in Slovenia in this century, which transformed, urbanized and even degraded large portions of the land. Many of the sites, recorded previously, would otherwise have completely escaped our attention.

The fact that ANSL includes information on sites from all geographic regions from the Palaeolithic to the early mediaeval period allows us to undertake certain comparative studies, and studies of long term processes. In spite of all the biasses inherent in the nature of the fieldwork and data gathered, it may still offer a basis for a reasonable range of conclusions about some major diachronic or synchronic trends, such as settlement concentration and fragmentation, intensification and colonization of various landscapes and ecological zones, the appearance of new site types and the introduction of new subsistence strategies and technologies, social and political groupings, major economic changes, and last but not least, the detection of major demographic dynamics.

In our study we divided Slovenia into five main regions: alpine (c. 2250 sq km), sub-alpine (c. 7550 sq km), dinaric (c. 5000 sq km), sub-mediterranean (c. 2000 sq km) and sub-pannonian region (c. 3200 sq km). We retained the chronological and functional division of the sites and we omitted undated and undefined sites. Initially, we treated all site types equally, but we paid more attention to settlement structures and cemeteries in the interpretation. Altogether, we operated with 2002 geographical locations which contained 2989 archaeological sites. As we were mainly interested in synchronic developments in the five main regions, we divided multi-period sites into a set of single-period sites, each of them corresponding to the period in question.

In Tables 6.3–6.8 and in graphs 1–4 (Figures 6.2–6.5) we have summarised regional, chronological and functional distributions of sites and site types.

INTERPRETATION OF THE DATA BASE

Tables (6.3–6.8) and graphs (1–4) (Figures 6.2–6.5) are actually more indicative for certain trends regarding the discovery of sites within various regions. The distributions are the synthesis of many processes involved in the discovery and recording of sites: intensive agricultural exploitation of land, bringing more finds to light, differential interest in certain site types, the assumptions of surveyors, their ability in recognizing archaeological materials, concentration on certain 'attractive' areas, etc...

The sites of objects/single finds in the Neolithic/Eneolithic, Bronze Age and in the Urnfield period present more than 50% of all sites (see Figure 6.2). Such a situation is especially pronounced in the sub-pannonian and in the sub-alpine region (Table 6.3). The sub-pannonian zone, where sites of objects/single finds in the Neolithic/Eneolithic period represent nearly 95% of all recorded sites, is the most significant. The reasons for this are to be sought in the relatively large proportion of arable land in the sub-pannonian region and in the sub-alpine region which are suitable for intensive cropping. These two regions were and still are the most important agricultural areas in Slovenia and long term land use has resulted in the high number of accidentally discovered single finds. The other reason lies in the comparatively high agricultural potential in these two areas, which resulted in denser settlement in the past.

In contrast to this, there are generally more settlement and cemetery sites than sites of stray finds documented in the dinaric and sub-mediterranean region. The chronological distribution of site types combined with the regional distribution clearly shows that the prevalence of settlement and cemetery sites over the single find sites is mainly due to the high number of the former appearing from the 1st millennium BC onwards (Iron Age and Roman sites). These two regions offered generally fewer opportunities for extensive cropping. The only higher concentration of the settlements based on a crop producing economy exists in the so-called 'covered karst' in the eastern part of this region, where the limestone geology is covered by relatively deep soils. Since most of the dinaric region is densely forested, and only larger karstic depressions offered suitable conditions for denser settlement and intensive cropping, large portions of land remained unsettled or were not agriculturally exploited. Since settlements and fields were always concentrated in the same areas, exploited at least from the Bronze Age onwards, it is reasonable to expect that in these areas more settlement and burial sites have come to light. The other important factor contributing to the relatively high proportion of such sites are caves, which were frequently used before the 1st millennium BC.

The situation changes in all regions at the transition to the period of the Early Iron Age, when people built numerous monumental standing structures, especially hillforts and large barrows. These features obviously received more attention from the topographers and excavators, and many of the previously discovered stray finds can be assigned to them. There is a clear prevalence of sites with standing structures in the Early Iron Age in all five regions. This trend can also be observed in the Late Iron Age and especially in the Roman period, where, with the exception of the sub-mediterranean region, cemeteries became the most frequent site type recorded.

Regions:

A – alpine
SA – sub-alpine
D – dinaric
SM – sub-mediterranean
SP – sub-pannonian

Site types:

S+C – settlement with cemetery
S – settlement
C – cemetery
CS – cave site
SF – objects/single finds
H – hoards
I – infrastructure (roads, bridges, milestones, enclosure walls, quarries, etc.)

Periods*:

P – Palaeolithic/Mesolithic
early Paleolithic: 250,000 – 125,000 BC,
middle Paleolithic: 125,000 – 37,000 BC,
late Paleolithic: 37,000 – 10,000 BC /
Mesolithic (c. 10,000 – 5500 BC)
N – Neolithic (c. 5500 – c. 3500 BC) / Eneolithic (c. 3500 – c. 2200 BC)
Br (E/M) – Bronze Age (Early/Middle) (c. 2200 – c. 1300 BC)
URN – Urnfield period (Late Bronze Age) (c. 1300 – c. 800 BC)
EIA – Early Iron Age (c. 800 – c. 300 BC)
LIA – Late Iron Age (c. 300 BC – 0)
R – Roman period
EM – Early Mediaeval period

* Chronological absolute periods are based on conventional chronology in Central European archaeology

Key to Tables 6.3–6.8 and Figures 6.2—6.5.

The early medieval pattern is in this respect very similar to the Roman, since many of the burial sites were discovered close to standing churches. However, the absolute figures for the Late Iron Age and the early medieval period are relatively low and cannot be considered as particularly representative.

The absolute figures clearly demonstrate a very high proportion of Roman period sites and sites from the Early Iron Age (Figure 6.3). These two peaks are clearly visible in the sub-alpine, sub-mediterranean and alpine regions. The Neolithic/Eneolithic sites are the second most frequent in the sub-pannonian region. This 'anomaly' is largely due to the very high number of stray find sites. If we examine the regional and chronological distribution of settlements and cemeteries only (Table 6.3), then this 'anomaly' disappears. However, in the dinaric region we discovered something which is in our opinion a meaningful anomaly: the prevalence of the Early Iron Age sites over the Roman sites. The pattern in the sub-mediterranean region, where the number of Roman sites only slightly exceeds that of the Early Iron Age sites, is very close to the dinaric pattern. Furthermore, the regional density of the settlement and cemetery site types (Figure 6.5) shows another meaningful 'anomaly' – the number of settlement and cemetery sites in the Early Iron Age is more than twice

Alpine	P	N/E	B	URN	EIA	LIA	R	EM	
S+C	0	0	0	0	6	1	2	2	11
S	0	1	0	0	21	2	5	6	35
C	0	0	0	1	6	1	16	10	34
CS	1	2	2	0	0	0	3	1	9
SF	0	0	2	9	4	6	24	5	50
H	0	0	0	0	1	0	3	0	4
I	0	0	0	0	0	0	3	0	3
	1	3	4	10	38	10	56	24	

Subalpine	P	N/E	B	URN	EIA	LIA	R	EM	
S+C	0	0	2	2	21	3	23	3	54
S	2	16	8	2	88	9	156	14	295
C	0	0	2	5	96	19	108	13	243
CS	7	5	0	1	4	3	2	0	22
SF	0	123	27	22	29	14	237	20	472
H	0	0	0	10	1	4	8	0	23
I	0	0	0	0	0	0	87	0	87
	9	144	39	42	239	52	621	50	

Dinaric	P	N/E	B	URN	EIA	LIA	R	EM	
S+C	0	0	1	1	44	8	19	2	75
S	1	1	0	5	87	3	30	3	130
C	0	0	0	5	129	7	121	4	266
CS	9	6	11	2	7	3	4	2	44
SF	0	20	10	13	21	9	84	7	164
H	0	0	0	5	0	0	3	0	8
I	0	0	0	0	0	0	21	0	21
	10	27	22	31	288	30	282	18	

Submediterranean	P	N/E	B	URN	EIA	LIA	R	EM	
S+C	0	1	1	1	4	1	3	1	12
S	0	0	0	0	123	1	36	1	161
C	0	1	1	0	2	2	21	11	38
CS	4	2	7	4	1	3	7	0	28
SF	0	5	1	1	2	7	59	3	78
H	0	0	0	4	1	0	3	0	8
I	0	0	0	0	0	0	16	0	16
	4	9	10	10	133	14	145	16	

Sub-pannonian	P	N/E	B	URN	EIA	LIA	R	EM	
S+C	0	0	0	3	8	3	25	1	40
S	1	4	5	3	11	1	32	2	59
C	0	0	1	6	29	9	105	8	158
CS	0	2	0	1	1	0	2	1	7
SF	0	141	13	19	17	13	76	3	282
H	0	0	0	5	0	0	1	0	6
I	0	0	0	0	0	0	47	0	47
	1	147	19	37	66	26	288	15	

Table 6.3 Functional and chronological distribution of sites.

Slovenia	P	N/E	B	URN	EIA	LIA	R	EM	
S+C	0	1	4	7	83	16	72	9	192
S	4	22	13	10	330	16	259	26	680
C	0	1	4	17	262	38	371	46	739
CS	21	17	20	8	13	9	18	4	110
SF	0	289	53	64	73	49	480	38	1046
H	0	0	0	24	3	4	18	0	49
I	0	0	0	0	0	0	174	0	174
	25	330	94	130	764	132	1392	123	

Table 6.4 Chronological distribution of site types.

Slovenia	A	SA	D	SM	SP
P	1	9	10	4	1
N/E	3	144	26	9	147
B	4	39	22	10	19
URN	10	42	31	10	37
EIA	38	239	288	133	66
LIA	10	52	30	14	26
R	56	621	282	145	288
EM	24	50	18	16	15

Table 6.5 Chronological and regional distribution of sites.

Slovenia	A	SA	D	SM	SP
S+C	11	54	75	12	40
S	35	295	130	161	59
C	34	243	266	38	158
CS	9	22	44	28	7
SF	50	472	163	78	282
H	4	23	8	8	6
I	3	87	21	16	47

Table 6.6 Regional distribution of site types.

Slovenia	A	SA	D	SM	SP
P	0,045	0,12	0,2	0,2	0,031
N/E	0,13	1,91	0,52	0,45	4,60
B	0,18	0,52	0,45	0,50	0,60
URN	0,45	0,55	0,62	0,50	1,15
EIA	1,70	3,20	5,76	6,65	2,10
LIA	0,45	0,69	0,60	0,70	0,81
R	2,49	8,20	5,64	7,25	9,00
EM	1,11	0,66	0,36	0,80	0,47

Table 6.7 Density of discovered sites (/100 sq km).

Slovenia	A	SA	D	SM	SP
P	0,005	0,12	0,20	0,20	0,03
N/E	0,13	0,28	0,40	0,20	0,19
B	0,08	0,16	0,24	0,45	0,19
URN	0,45	0,12	0,22	0,25	0,38
EIA	1,47	2,71	2,62	6,45	1,50
LIA	0,18	0,41	0,36	0,20	0,40
R	1,00	3,80	3,40	3,00	5,10
EM	0,80	0,40	0,18	0,65	0,04

Table 6.8 Density of recorded settlements and cemeteries (/100 sq km).

the number in the Roman period. The reasons for this may be manifold: the actual settlement intensification in the Early Iron Age, depopulation in many areas caused by violent Roman occupation, and last but not least, the aggregation of a larger amount of population in a few urban centres.

As was stated above, the archaeological topography and work on the central site register is still going on in Slovenia. Most of the sites discovered after 1965 are recorded on an annual basis in the *Varstvo spomenikov*, the journal of the Cultural and Natural Heritage Protection Office. The number of sites discovered after 1965 amounts, by a rule of thumb, to 30–40% of the number recorded in ANSL. The work in the last three decades to a great extent supports the patterns described above. However, there are some important improvements that can be made. The Urnfield and Late Iron Age periods are definitely under-represented in ANSL. Many of the settlements in the western dinaric and sub-mediterranean region recorded as Early Iron Age hillforts were founded before the 8th century BC and should also be treated as Urnfield period sites. Furthermore, many of these sites in these two regions also continued in use in the Late Iron Age. They were settled practically to the Roman period and there was no break in occupation in the period of the late 4th and early 3rd century BC (the arrival of Celts), as there seems to be elsewhere in Slovenia. Another problem associated with Late Iron Age period sites is the relative difficulty in the recognition of the finds, especially the pottery, which does not belong to the Celtic tradition.

Another important fact, affecting the image of settlement patterns based on the data from ANSL, is the recent discovery that some of the hillforts in the eastern dinaric zone, which were previously exclusively dated to the Early Iron age, can now be shown to be Eneolithic in date (Dular *et al.*, 1991). Although they are still relatively low in number, they might be indicators of important changes in this period, especially regarding the socio-economic and colonization processes in the areas previously not known for their Eneolithic settlement. The proportion of the lowland, undefended sites from the Bronze and Iron Ages has also increased in the last few decades. However, they have not changed our interpretation of the settlement pattern composed mostly of the hillfort sites, but rather completed the overall structure.

As the data from ANSL do not allow precise quantitative analysis regarding the size of sites (e.g. the size of settlements or population buried in the cemeteries), these facts will be mentioned in the text below. However, the appearance of the larger communal cemeteries with populations of 50 or more, started at the beginning of the 1st millennium BC with the late Urnfield period (Gabrovec, 1987). Prior to this, there are only few graves discovered from monumental barrows or reconstructed from the finds stored in museums. The most abundant cemeteries in terms of population size or the investment of manpower needed for the construction of the mortuary monuments belong to the Early Iron Age (c. 800 – 300 BC) when a few large mortuary sites, like Most na Soči and Kobarid in the alpine region, Novo mesto, Stična, Magdalenska gora, Podzemelj, and some others in the dinaric region, contained altogether more than 10,000 burials. Such a massive burial record is only duplicated in the Roman urban cemeteries in Slovenia some centuries later. Nevertheless, the mortuary data support the model of two major peaks in the settlement history in Slovenia, the Early Iron Age and the Roman period. However, what

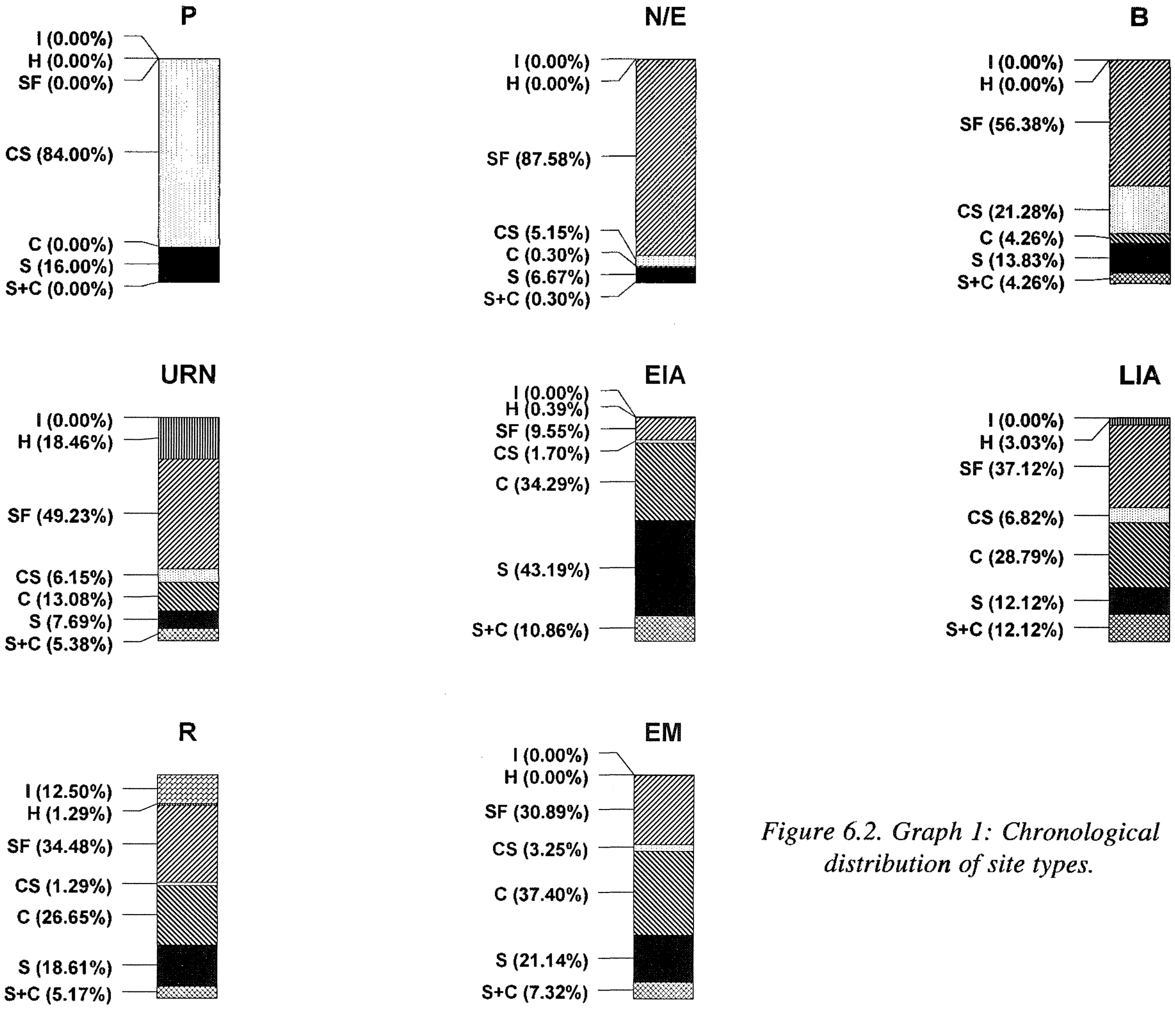


Figure 6.2. Graph 1: Chronological distribution of site types.

the ANSL data do not show, is that the difference is not so much in the number of mortuary sites, especially with regard to the Middle and Late Bronze Age, but in the increase in the size of the mortuary population in the Late Bronze Age.

AN ATTEMPT AT DEMOGRAPHIC ANALYSIS

Due to the nature of the data recorded in ANSL, the demographic issues discussed here will be reduced mainly to major trends and social changes as can be seen through the settlement and colonization processes. For this reason weighted values of single periods by centuries has not been done, since there will be no changes regarding the main trends studied, and due to the even bigger differences between the single periods the graphs will appear less comprehensive.

The earlier periods (the Neolithic/Eneolithic, the Early and Middle Bronze Age and to some extent even the Urnfield period) are, as we can see from Table 6.3, mainly represented by the sites of stray finds and only by a few settlements and cemeteries. The Early Iron Age and Roman period offer better possibilities for demographic studies, as all types of sites are represented in considerable numbers.

Palaeolithic

The Palaeolithic period, represented by more than 40 sites today, is still a rather unknown period. Due to the relatively rare sediments older than the Riss glacial, there are only 3 cave sites, that among other finds probably also contain some Lower Palaeolithic stone tool remains. The number of sites with Middle Palaeolithic material is greater (15 sites), but still too small for any reasonable conclusions regarding demographic changes. However, one trend is already visible from this period onwards, namely the concentration of the Palaeolithic sites (mostly cave sites) around Pivka polje in the western part of the dinaric zone. The concentration of the sites in this area is even more emphasized in the Upper Palaeolithic. The reasons for such a concentration of sites around Pivka polje (see also Table 6.3), probably lie in the fact that the area is rich in caves and various rock shelters, suitable for permanent or temporary settlement and secondly, that archaeologists have paid special attention to these types of sites due to

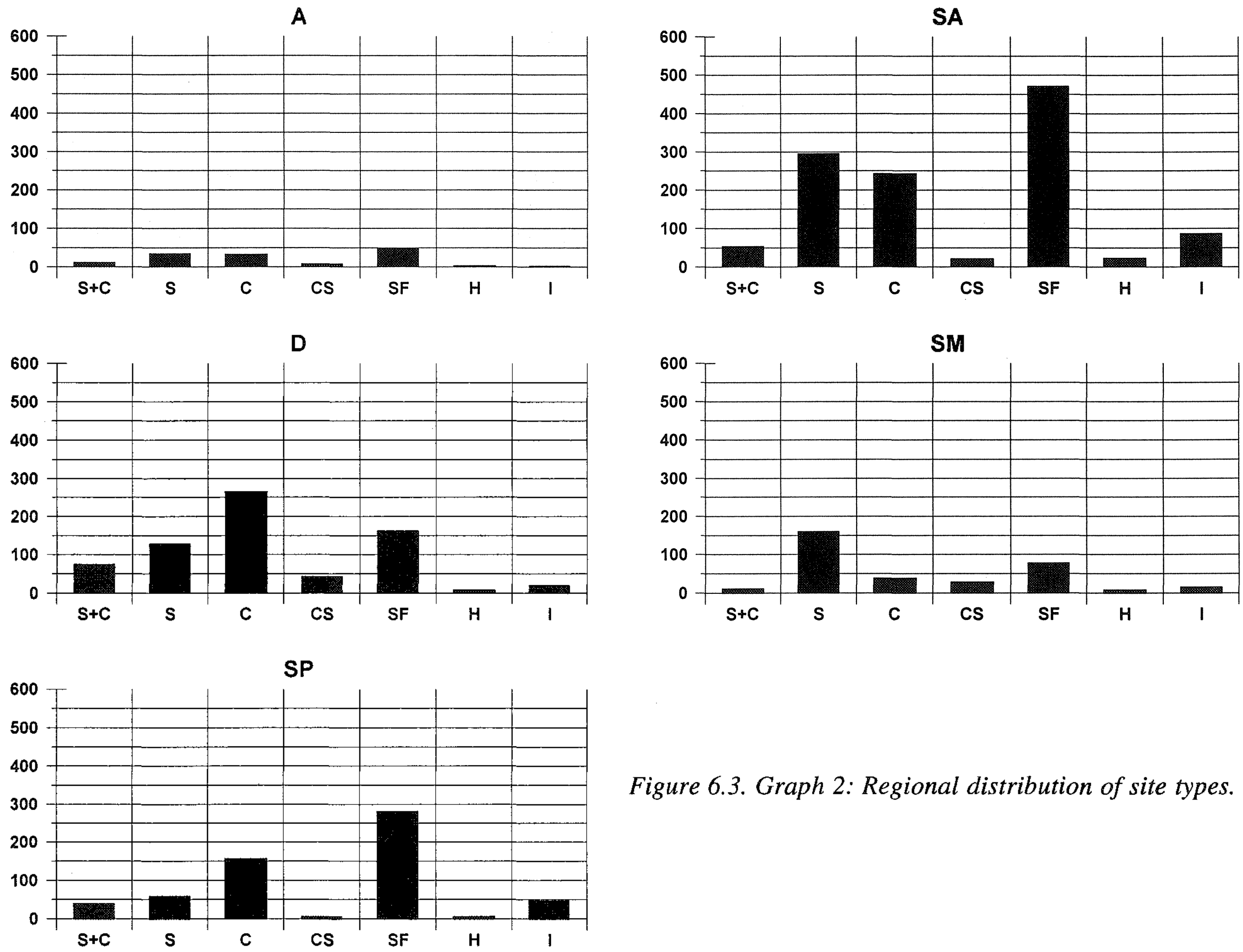


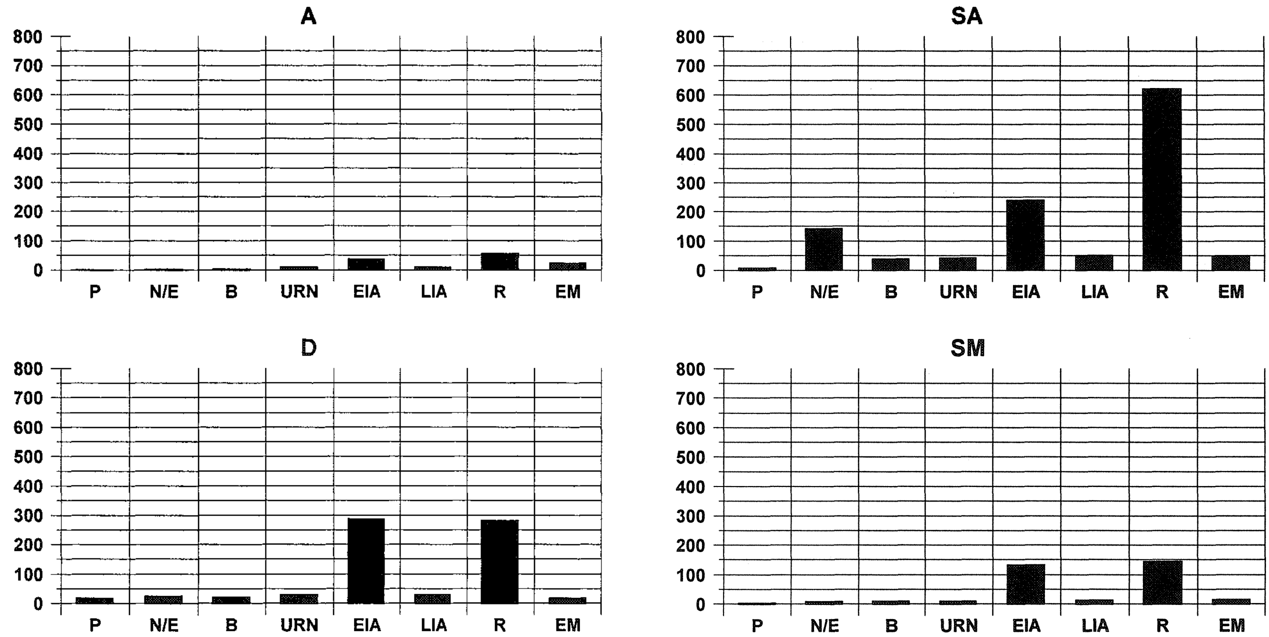
Figure 6.3. Graph 2: Regional distribution of site types.

the better preservation of the Pleistocene sediments. Also the interface between the lower polje and relatively high mountains probably offered the possibility of the exploitation of the natural resources from both ecozones. In this respect, it is worth mentioning the relatively large quantities of reindeer bones in some Upper Palaeolithic sites near Pivka polje (Osole, 1979), which could suggest the exploitation of the reindeer herds, moving from summer pastures in the higher areas to the winter pastures in the polje. However, the number of sites, and especially the problem of their contemporaneity, still does not allow any more precise conclusions. Nevertheless, the concentration of the Middle and Upper Palaeolithic cave sites in the Pivka polje suggests that the dinaric zone offered more suitable conditions for settlement than other regions in this period.

Neolithic and Eneolithic

The first considerable Neolithic settlement appeared in two regions independent of each other, in cave sites in the sub-mediterranean region and in open area sites in the sub-pannonian region or at the interface of this region with the dinaric or sub-alpine regions. In the latter two cases, the landscapes where the Neolithic sites were found, tend to be very similar to the sub-pannonian locations. The alpine region was to a great extent unattractive for the early farmers.

The Neolithic/Eneolithic sites in the sub-mediterranean region of Slovenia are still very few, so for better understanding, we have to include the sites from the neighbouring Trieste hinterland, which is actually part of the same eco-region. If we take into account both areas, we can see the strong prevalence of cave sites, very clearly clustered in the Karst. This trend actually continued from the Neolithic to the Early Bronze Age, until the appearance of the first hilltop settlements. The Neolithic and Eneolithic sites in the sub-mediterranean region were part of the Eastern Adriatic cultural milieu, and reflected strong influences from the Danilo and Hvar cultures in the Middle and Late Neolithic and from the Adriatic cultures in the Eneolithic period (Batović, 1979: 524, 575). Throughout the Neolithic and Eneolithic periods, the settlements remained small and could not support a large population. There is also no evidence of any kind of central settlements in this area. The economy to a great extent depended on



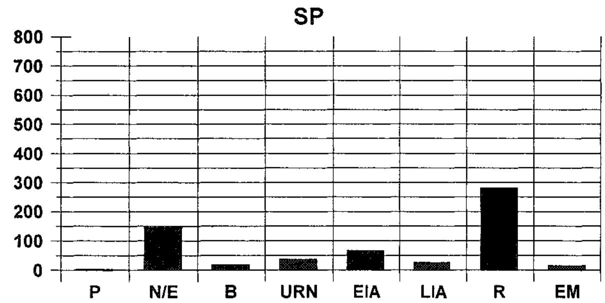


Figure 6.4. Graph 3: Regional distribution of sites.

foraging and hunting, as suggested by the faunal remains. In only a few cases can the Neolithic and Eneolithic settlement in the Karst (Slovene and Italian) be found in the alluvial plains of the smaller rivers, which might also be the result of the active hydrographic history of these areas.

The Neolithic and Eneolithic settlement in continental Slovenia exhibits a different development. The appearance of the first agricultural settlements in the sub-pannonian region or in similar landscapes with rich soils, clearly shows a common pattern of the agricultural exploitation of fertile river terraces in the lowlands. Although the recorded settlements are still rare (c. 15% of all sites from the Neolithic/Eneolithic period), the high proportion of the stray finds in the sub-pannonian and sub-alpine region suggests that the colonization of agriculturally fertile land was relatively extensive in these two regions. Culturally, the sites and finds from the Neolithic period can be affiliated with the Pannonian Basin cultures, particularly the various manifestations of the Lengyel culture in the western Pannonian Late Neolithic and Lengyel Culture-based manifestations in the Early and Middle Eneolithic. Settlements from these two periods tend to be very small (small village or hamlet type), located in close proximity to the fields they exploited. There is no evidence for larger aggregations of population throughout these two periods in either of the regions, and the pattern of small villages or hamlets remained virtually unchanged at least until the Late Bronze Age. Apart from one cave used as a cemetery (Ajdovska jama near Krško in the sub-pannonian zone, where at least 28 individuals were buried, see Horvat, 1989) there is no other evidence for cemeteries. The only considerable concentration of sites is at Ljubljansko barje (southern sub-alpine region), where nearly 20 pile dwelling sites were discovered in the marshland. Altogether, they span the period from the Late Neolithic to the Early Bronze Age. In the Late Eneolithic, we can assume that some of the sites in the Ljubljansko barje gained a supra-regional importance, since they were producers of metal objects and were involved in long-distance exchange, associated mainly with the pannonian Vučedol Culture.

The evidence for Neolithic and Eneolithic settlement in the sub-mediterranean and continental zone argues for the marginal position of Slovenia in relation to the main cultural centres in the Central Adriatic and the Pannonian Basin. In all five regions the density of settlement is very low and most sites tend to be of Eneolithic date. The same is true of the sites of stray finds, most of which in the sub-

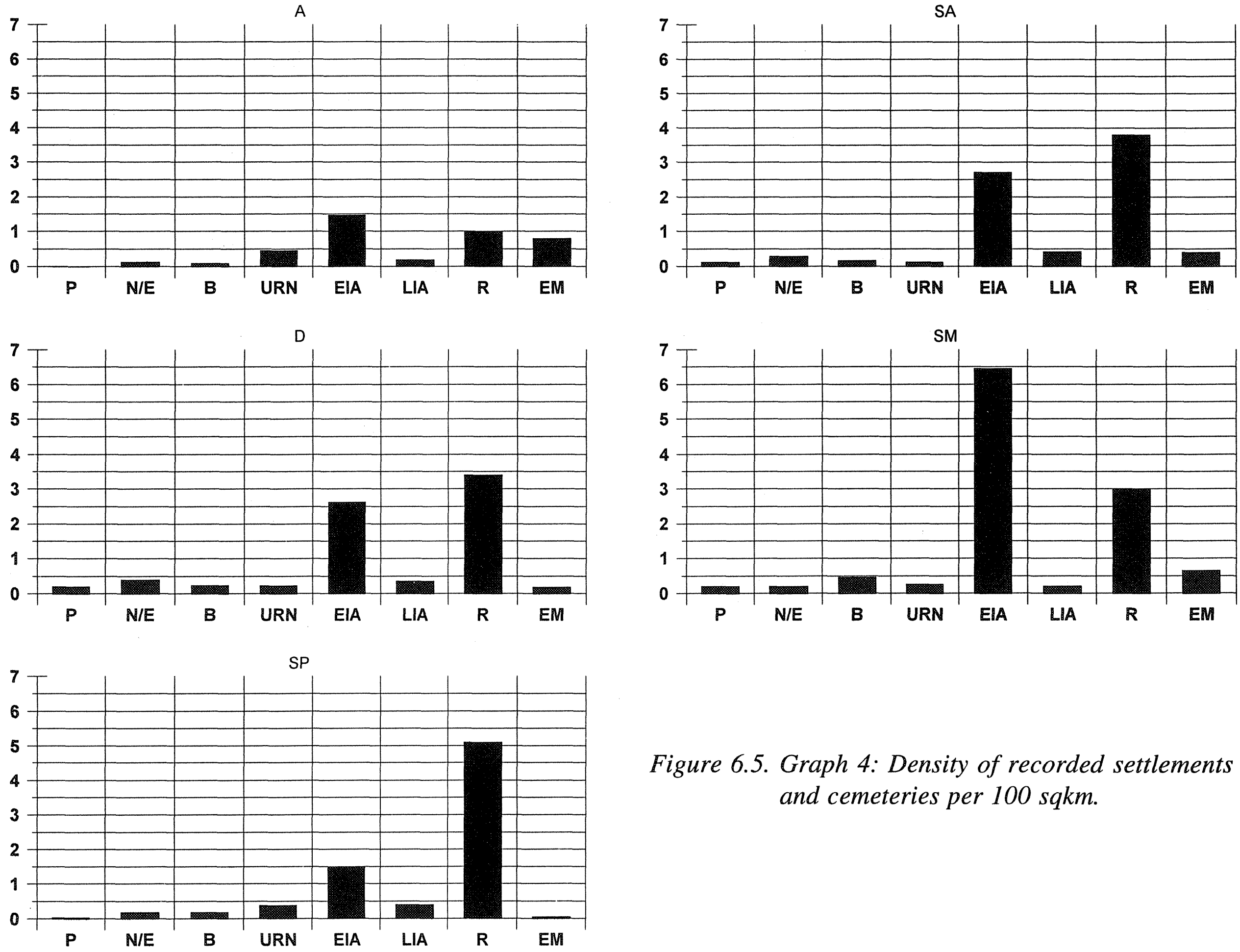


Figure 6.5. Graph 4: Density of recorded settlements and cemeteries per 100 sqkm.

pannonian region are the sites of polished axes. The first stabilisation of the settlement pattern belongs to the Late Neolithic and Early Eneolithic. The general trend in continental Slovenia is one of the gradual and relatively slow filling up of the landscape.

Bronze Age (Early/Middle)

The Early and Middle Bronze Ages in comparison with the Eneolithic period, are periods of even more fragmented settlement and decreased population. After a stabilisation of the early farming communities in the Neolithic and Eneolithic periods, many of the previously existing settlements ceased to exist in the Bronze Age. The figures for the EBA and MBA are very low in all five regions. There are some problems with the cave sites in the sub-mediterranean and western dinaric regions, which contained some Bronze Age layers, but were not sufficiently well excavated to allow us more precise conclusions. However, the dual cultural development, traced in the Neolithic and Eneolithic, of the sub-mediterranean and continental parts is less distinctive in the Early Bronze Age, because the cultural tradition of the Eneolithic Vučedol culture seems to be present throughout Slovenia. The situation changes in the Middle Bronze Age, when once again two distinctive cultural regions can be found: the Adriatic oriented early hillfort culture (early Castellieri group) in the sub-mediterranean region, and the so-called Eastern Alpine Barrow Culture in the continental parts. Nevertheless, though the sites, including the stray finds, are very rare in this period in the whole of Slovenia, it is possible to trace two types of settlement: lowland settlements in the sub-pannonian region and hilltop settlements at the interface of the sub-alpine and sub-pannonian region. There is also some evidence of social ranking visible in barrow burials containing bronze objects (Gabrovec, 1987: 45).

Altogether, the Early and Middle Bronze Age are definitely the periods of demographic decline in all five areas. There is also no evidence of any kind of migrations from outside Slovenia or colonisation of less favourable areas for agriculture. Also there are no centres found, not even on the scale of the Ljubljansko barje in the Late Eneolithic.

Late Bronze Age (Urnfield period)

In comparison with the EBA and MBA, the Late Bronze age presents a radical change in many ways. Larger

communal cemeteries appeared for the first time all over Slovenia. In each region, we can find some central settlement areas, distinctive for population aggregation: the Škocjan area in the sub-mediterranean, the Bled area in the alpine, the Ljubljana area in the sub-alpine, Mokronog and Novo mesto areas in the dinaric, Dobova (Lower Save valley) and Pobrežje, Ruše, Maribor (Drave valley) in the sub-pannonian region. All five regions, to a lesser extent including the sub-mediterranean, exhibit very strong cultural ties with the Pannonian and the eastern Alpine areas. However, the central zone of Urnfield settlement in Slovenia is in the sub-pannonian region. The tables and graphs derived from the data in ANSL are less reliable in this respect, as they do not include site dimensions. However, due to the 'sudden' appearance of the Urnfield sites, their strong ties with the Pannonian basin, and the apparent increase in population in comparison with the previous periods, there are some reasons to suggest migrations, which came from the east along the main river routes. Nevertheless, a quite intense colonisation of the fertile lands took place. According to the burial data, it seems that the lower Save valley was colonised in the 12th century BC, a century or more before the major colonisation of the Drave valley. The expansion of the Urnfield Culture in Slovenia is undoubtedly associated with the spread of more intensive farming, since most of the sites with larger cemeteries are directly associated with fertile lands. In addition, there is some strong evidence that hilltops were also settled in this period, as suggested by the data from the dinaric zone.

The only region that exhibits elements of internal cultural and even demographic development is the sub-mediterranean region, where the Castellieri Culture, which appeared in the Middle Bronze age, continued its development and colonisation of the region. The number of the hillforts in this area multiplied greatly.

The important phenomenon in this period is the appearance of numerous hoards containing bronze objects. Most of them belong to the Early Urnfield period (1300–1000 BC) and are distributed in all five regions, whilst the numerous settlements and cemeteries appeared somewhat later and tend to be more associated with the sub-pannonian region and similar landscapes elsewhere. Most of the settlements appeared in the Late Urnfield period (after c. 1000 BC), when the deposition of hoards almost ceased. Such mutual exclusivity of site types could argue for the possibility that many of the Urnfield bronze objects were in circulation before the major Urnfield colonisation took place.

Early Iron Age

The demographic increase already visible in the previous period, undoubtedly accelerated in the Early Iron Age. This process is clearly visible throughout Slovenia, and is especially apparent in the sub-mediterranean and dinaric regions. The figures, either relative or absolute, are so striking, compared to the Late Bronze Age and Late Iron Age, that there can be no doubt about the economic and social prosperity in the Early Iron Age. Settlement density in the sub-mediterranean region (see Figure 6.5) is the highest settlement density recorded in Slovenia, and only Roman urban settlement can be compared with it. The distribution of the settlements in this period strongly suggests that all Slovenian territory, except some areas in the high Alps, was completely colonised. Furthermore, not only the most fertile areas within the individual regions, but also the areas with less potential for agricultural production were densely settled. This fact also speaks for the intensification process and for the development of regional communal identities. The process of differential cultural developments in the sub-mediterranean and continental part, which had already begun in the Bronze Age, developed into strong regional identities within the continental part itself. There are four very distinctive groups in Early Iron Age Slovenia (Gabrovec, 1987: 27): the Sveta Lucija group at the contact zone between the alpine and sub-mediterranean, the Notranjska group in the sub-mediterranean and western dinaric region, the Dolenjska group in the eastern dinaric zone and the contact zone with the sub-alpine area, the Klein-Klein-Martijanec group in the sub-pannonian part and in the eastern sub-alpine area. The first three exhibit strong evidence for a great demographic increase.

The Notranjska group is represented by more than 150 hillforts in a territory no greater than 1,000 sq km, all more or less marked by a massive stone rampart. The economy of this group, due to natural conditions, is mostly based on sheep and goat keeping and small-scale agriculture, where possible. Agricultural exploitation was probably more intense in the littoral part. Unfortunately, the very small number of known cemeteries does not allow any more quantitative conclusions.

The Sveta Lucija group, with its centres in the Upper Soča valley in the alpine foothills, presents an interesting case, since most of the population was concentrated in 3 sites with large cemeteries: Most na Soči (Santa Lucia, c. 6,500 graves, Kobarid (c. 1,000 graves) and Tolmin (c. 500 graves), spanning c.800–300 BC. An interesting phenomenon, associated with these cemeteries, is the relatively low level of social ranking expressed in the grave goods compared to the other Early Iron Age groups in Slovenia. The subsistence base, especially the agricultural resources in the vicinity of the central sites, was probably not the reason for such a demographic increase. The prosperity of this group was probably based on the extraction or control of the alpine iron ore sources, and production of iron objects. The existence of a "craftsman quarter" (Svoljšak, 1980) in the settlement of Most na Soči, suggests that there was a part of the population involved in full-time manufacturing activities. The grave goods very clearly demonstrate long distance exchange with numerous communities in the Alps, the Friuli plain, and the Balkans.

The Dolenjska group represents the strongest and most developed Early Iron Age group. Its social structure, mostly reconstructed from the mortuary data, represents the most highly ranked society in Slovenia, with large central hillforts and communal burial barrows. The site of Stična, one of the most important centres of this group, consists of a hillfort covering an area of nearly 30 ha, with an associated cemetery of 125 recorded barrows, probably containing several thousands of individuals buried between the 8th and 4th century BC (Gabrovec, 1994). Similar centres can be found at the sites of Novo mesto, Magdalenska gora, Vače, Vinji vrh, Podzemelj etc. The population of this group was intensively engaged in long distance exchange with north Italian communities, northwest Balkan and Pannonian groups (amber, glass beads, fine metal vessels etc.) It has since been proved that they were also important producers of metal objects.

The Klein-Klein-Martijanec group had a somewhat different demographic development. To a great extent they followed the demographic and social trends visible in other areas (increase in number of settlements, large cemeteries, etc.) but this seems to have ended at the beginning of the 5th century BC (Teržan, 1990: 204). The reason for this trend, which has also been found in the wider western Pannonian region, has still not been properly explained. The change in burial rite at the beginning of the 5th century BC, the shift from cremation graves in barrows to flat inhumation graves, suggests important changes in social organization. The apparent decrease in population size could be also the result of the lesser visibility of the later flat cemeteries. However, there is an hypothesis which links the apparent collapse of this group with the invasion of the Pannonian Basin by the Scythians. On the other hand, the cause of this collapse has been sought in a major epidemic disease (plague) that attacked livestock, and which is based on the interpretation of some non-contemporary latin sources (Šašel and Šašel, 1985).

Late Iron Age

The invasion of the Celts was the most important cause of an abrupt change in the settlement pattern. By the 3rd century BC the power of the traditional Early Iron Age centres in all but the sub-mediterranean and western sub-alpine region collapsed. However life continued in some of them, but, as the burial evidence suggests, on a smaller scale. Celtic colonisation actually affected mostly the areas along the main rivers and their alluvial plains. One of the most visible shifts in the settlement pattern is the shift from hilltop settlement to lowland locations. To a certain extent the Celts colonised the regions similar to those colonised by the Urnfield groups, e.g the areas within the sub-pannonian region, and similar landscapes in the sub-alpine and dinaric areas. However, a larger Celtic population in these areas can be traced only from the 1st century BC onwards and continues in the Roman period, which in the 1st and 2nd century AD increased even more, due to the stable economic and political developments. It is particularly apparent in the epigraphic data from the major Roman towns in Slovenia: in Emona, the modern town of Ljubljana in the southern alpine area, in the town of Celeia (the modern town of Celje) in the eastern sub-alpine area and the town of Neviodunum in the southern subpannonian area, all established in the 1st century AD. The second evidence for the probable increase of the local population in the sub-pannonian region is the very frequent appearance of a distinctive burial type (Noric-Pannonian barrows). The countryside remained settled mostly by the autochthonous peoples, whilst the immigrant, Roman population, was concentrated mostly in the towns.

The sub-mediterranean and alpine regions lay outside of the major colonisation areas of the Celtic peoples in the Late Iron Age. In spite of this, there were major demographic changes in both of these regions. The extensive cemeteries in Most na Soči, Tolmin and Kobarid either ended or exhibit much smaller mortuary populations in the Late Iron Age (see Guštin, 1991). There is also almost no evidence of shifts in settlement to new locations. However, in the southern part of this zone there is some evidence for the strong tribal community of the Histrians (Istria) and their expansion towards the north. Roman authors used the term *rex/regulus* for the title of Histrian leaders in the first decades of the 2nd century BC (for example Livy, *Ab Urbe condita*, XLI 11, see details in Čače, 1978/79). The Romans established the colony of Aquileia in 181 BC as a base for their advance to the east and to control the expansion of the Histrians. All in all, it seems that the pattern of numerous hillforts in the Karst remained largely unchanged until the Roman conquest of this territory in 177 BC, followed by the massacre and enslaving of the local population. Unfortunately, the data which would allow more precise chronological conclusions, are lacking. However, with the establishment of Roman rule, a great number of hillfort settlements ceased to exist, and settlements shifted to the lowlands and appeared as a large number of probable village-type sites or hamlets. Roman villas are concentrated only in the areas with better agricultural conditions in the Littoral and in some lower areas in the alpine valleys. The Karst, with its unfavourable conditions for extensive fields, shows a prevalent pattern of smaller villages which were frequently located at the foot of the former hillforts. Nevertheless, the overall picture of the Roman period in the first two centuries AD, in comparison with the Late Iron Age, represents a large increase in settlements as well as population.

CONCLUSION

The patterns derived from ANSL and newer data clearly present rhythmic changes in settlement expansion, and consequently in demography. The first general conclusion

for all five regions is that they were marginal with regard to major cultural and social centres, at least until the 1st millennium BC. Another important fact is the lack of any central places prior to the Urnfield period, if not until the Early Iron Age. The differential development of the sub-mediterranean and continental parts remained a constant throughout prehistory, but both parts reflected the same rhythms in demographic increase and decline.

The sub-pannonian region, the region closest to the fertile Danubian lowland, tended to be the most attractive for the colonization and migration processes associated with agricultural intensification from the Neolithic period onwards. On the other hand, the alpine region, with the exception of the Sveta Lucija group, remained sparsely settled until Roman times. However, this Early Iron Age group settled the territory of the Soča river, which is more open to the south, e.g to the sub-mediterranean area and to the Friuli plain, and it was an area which never developed a highly distinctive cultural group in prehistory.

The sub-mediterranean area exhibited distinctive features in the Neolithic, Eneolithic and to a great extent in the Bronze and Iron Ages in comparison with the continental parts, and was somewhat isolated from them. On the other hand, the dinaric and sub-alpine regions, actually the transitional zone, frequently reflected trends deriving from the sub-pannonian and sub-mediterranean regions. Furthermore, the dinaric and sub-alpine regions were the only regions where certain groups gained a supra-regional importance, especially in later prehistory. The reasons for this are to be sought in sets of complementary economies, which were made possible by a rich geomorphological spectrum of landscapes within these two regions, in sources of metal ores and in their transitional position between the Alps, Pannonian Basin, northwestern Balkans and Adriatic. It seems that these two regions are central to the questions of major cultural and social changes, since, in the event of larger social and economic collapses in the dinaric and sub-alpine regions, all other regions where affected to a great extent as well. On the other hand, e.g. in the case of the end of the Klein-Klein-Martijanec Early Iron Age group in the sub-pannonian area, the dinaric and sub-alpine regions remained unaffected in terms of the settlement pattern, the number and richness of the burials, and the demographic situation.

There are two demographic peaks visible, the Early Iron age and Roman period, in all five regions. It is reasonable to expect that in these two periods all of Slovenia was colonised, with the exception of a few high alpine and dinaric areas, which are unsettled even today. However, due to the nature of the available data, it is not possible to make any more precise demographic conclusions by comparing these two periods, since the Early Iron Age and Roman settlement reflected different types of territoriality. The Early Iron Age communities exhibit strong control over territory, whilst the Roman population concentrated in urban centres and along main roads. However, both periods ended with a large social, economic and demographic collapse, and some centuries were needed for the restoration of the previous settlement and population density.

The historical processes, especially the colonisations, migrations and political grouping, tended to be determined by geographic barriers. The Celtic and the possible Urnfield migration were centred mainly in the sub-pannonian region. Political associations, prior to the Roman period, tend to be confined to a local region.

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7. Prospection Archéologique et Démographie en Provence: Approche Paléodémographique de la Rive Occidentale de L'Etang de Berre sur la Longue Durée

Frédéric Trément

Lorsque J. Bintliff m'a demandé de traiter le sujet 'Prospection et démographie sur le long terme en Provence' dans le cadre du colloque de Durham, il me parut dans un premier temps que l'abondance, la dispersion et l'hétérogénéité des données accessibles jointes à la rareté des études diachroniques en Narbonnaise et plus particulièrement en Provence faisaient de cette proposition une gageure. Il n'était assurément pas question pour moi d'entreprendre une synthèse régionale couvrant un champ chronologique et géographique trop large pour être maîtrisé par un seul chercheur. D'un autre côté, la récente éclosion des recherches microrégionales dans le Midi ainsi que l'opportunité exceptionnelle offerte par le passage du TGV-Méditerranée dans la basse vallée du Rhône invitaient à poser la question de l'occupation du sol en termes nouveaux. L'heure de la synthèse de ces précieuses informations n'étant pas encore venue, le plus raisonnable me sembla de cultiver mon jardin en réfléchissant aux moyens de traiter et d'interpréter dans une perspective démographique les données accumulées au cours de sept années de recherches dans la région des étangs de Saint-Blaise, espace de 100 km^2 situé sur la rive occidentale de l'Etang de Berre (Bouches-du-Rhône). Là, l'intensité des prospections, les conditions remarquables de lisibilité, la masse considérable des artefacts recueillis en surface, le type de traitement des données mis en oeuvre et l'élargisseent des problématiques archéologiques à l'ensemble du paysage autorisaient une approche relativement fine du peuplement, susceptible de servir provisoirement de modèle (Trément, 1994 and in press).

MESURER QUOI? PROBLEMES METHODOLOGIQUES

En l'absence de données chiffrées antérieures au Moyen Age, l'analyse paléodémographique du secteur concerné ne peut porter que sur des estimations relatives du peuplement basées sur les données archéologiques fournies par les prospections. Deux questions se posent: – Quels sont les critères utilisables? – Et parmi eux, quels sont les plus pertinents?

Le nombre d'artefacts

Le nombre total de fragments de céramique recueillis en prospection constitue un premier indicateur des activités et donc du peuplement d'une région donnée, même s'il est certain qu'à certaines époques une partie du mobilier domestique était constituée de matériaux périssables (Figure 7.1). Les prospections systématiques ont permis de recueillir 16673 artefacts, dont 15896 ont pu être rattachés à une phase culturelle et 2223 déterminés d'un point de vue typologique. La répartition de ces éléments dans le temps est extrêmement inégale. Près de 99% sont postérieurs au début de l'Age du Fer : 29% se rapportent à l'Age du Fer, plus de 25% à l'époque romaine et plus de 44% au Moyen Age. Si l'on considère uniquement les formes de céramiques, le Néolithique et l'Age du Bronze sont mieux représentés avec respectivement 4% et 3% des bords, l'Age du Fer l'est nettement moins (13%), l'époque romaine rassemble 41% des bords et le Moyen Age 39%.

Le nombre d'occurrences

Autre critère utilisable pour reconstituer l'évolution relative du peuplement, la somme des points ayant livré des indices se rapportant à une période donnée permet de pondérer les quantités brutes d'artefacts en tenant compte de leur dispersion et des effets de sur- et de sous-représentation induits par les facteurs 'post-dépositionnels' (conditions de sédimentation, érosion, densité du couvert végétal, pratiques aratoires). Par ailleurs, chaque site ou point de découverte est comptabilisé autant de fois qu'il couvre de phases culturelles différentes, ce qui permet de prendre en considération sa durée d'occupation. Sur un total de 412 occurrences, 0,7% se rapportent au Mésolithique, 14% au Néolithique, 3,6% à l'Age du Bronze, 24% à l'Age du Fer, 28% à l'Antiquité romaine et 29% au Moyen Age. On obtient là pour les époques historiques l'image, très voisine

de la précédente, d'un gonflement important des activités humaines au cours de l'Age du Fer, suivi d'un tassement progressif durant l'époque romaine et le Moyen Age. En revanche, le Néolithique se distingue clairement au sein des périodes préhistoriques par une très grande dispersion des artefacts dans l'espace.

Le nombre d'occupations de sites

Dans la plupart des travaux portant sur les questions de peuplement, c'est le nombre de sites occupés au cours de chaque période qui est pris en considération. Dans le cas présent, j'ai pris le parti de comptabiliser chaque site autant de fois qu'il couvre de phases culturelles différentes. Evidemment, seul l'habitat rural dispersé est concerné; à partir de l'Age du Fer et surtout à l'époque romaine, l'émergence des agglomérations et le développement du fait urbain constituent des facteurs démographiques essentiels. Plus de 85% des 163 occupations de sites comptabilisées sont postérieures au début de l'Age du Fer, et se répartissent à peu près également entre l'Age du Fer (26%), l'époque romaine (30%) et le Moyen Age (29%). Le Néolithique et l'Age du Bronze totalisent respectivement 6,1% et 6,7% des occupations, tandis que le Mésolithique n'en représente que 1,8%. Une fois de plus, l'image obtenue est celle d'un gonflement progressif du peuplement sur le long terme. Au sein de cette évolution très régulière, l'Age du Fer s'inscrit comme un pallier quantitatif déterminant.

La superficie totale habitée

La dimension des sites peut constituer aussi un précieux indicateur démographique. La superficie apparente d'un site est presque toujours exagérée par rapport à l'extension réelle des vestiges; on supposera que le rapport entre image de surface et structures enfouies est constant. D'autre part, la superficie d'un site peut varier dans le temps. Or dans la plupart des cas il est impossible d'estimer l'ampleur de cette variation et il faut se contenter de prendre en compte l'extension maximale des artefacts, toutes périodes confondues. Les résultats sont néanmoins dignes d'intérêt. L'évolution de la somme des superficies habitées reproduit assez fidèlement celle qui est obtenue à partir du nombre de sites. Trois seuils caractérisés par une augmentation significative peuvent être distingués: le Néolithique, l'Age du Fer et l'époque romaine. La surface habitée passe ainsi de 2 ha au Mésolithique à 10 ha au Néolithique; elle se maintient à 9 ha au cours de l'Age du Bronze, avant de s'élever à 30 ha à l'Age du Fer et de culminer à 36 ha à l'époque romaine. Mais à la différence de la courbe précédente, le Haut Moyen Age coïncide ici avec une régression de la superficie totale habitée, qui retombe à 30 ha.

Le territoire exploité

L'élargissement du champ d'étude des activités humaines à l'ensemble du territoire contrôlé et exploité est susceptible de fournir une image complémentaire du peuplement d'une aire géographique donnée à un moment donné. Pour chacune des grandes phases chrono-culturelles retenues, le territoire exploité a été défini comme l'aire d'extension maximale des vestiges identifiés en surface et distants de moins de 2 km, qu'il s'agisse d'établissements agricoles ou d'épandages de tessons liés aux façons culturales. Lorsque les vestiges sont séparés de plus de 2 km, les aires de concentration ont été dissociées. Les établissements isolés se sont vu attribuer un territoire d'exploitation de 314 ha correspondant, arbitrairement, à un rayon d'un kilomètre. Ce rayon a été doublé dans le cas des agglomérations, soit une superficie de 1256 ha. Les superficies obtenues, relativement importantes, sont susceptibles de correspondre à des terres cultivées mais également à des aires de prélèvement impliquant des activités très diverses (chasse, pêche, élevage, extraction, réserves de bois). L'évolution des superficies exploitées sur la longue durée suit fidèlement la tendance observée précédemment. Au Paléolithique, l'espace contrôlé par les occupants de l'Abri Cornille, de Mourre Poussiou et de Capeau est estimé, arbitrairement, à 950 ha, soit, pour chaque communauté, un rayon d'activité de 1 km. Il est évident que ce territoire devait être beaucoup plus étendu, compte tenu du type d'activités pratiquées dans un contexte social faiblement sédentaire. Au Néolithique, le territoire exploité s'étend sur 4259 ha. L'occupation du sol n'est plus organisée, comme à la période précédente, autour de quelques regroupements de populations; elle se caractérise, à partir du Néolithique final, par une forte dispersion du peuplement. A l'Age du Bronze, le territoire exploité paraît se rétracter (2500 ha) autour de quelques pôles d'habitat éloignés les uns des autres. A l'Age du Fer, l'émergence des agglomérations de Saint-Blaise, de l'Ile de Martigues et du Castellan est à l'origine d'une expansion et d'une stabilisation de l'agrosystème. L'aire de prélèvement peut être estimée à 3750 ha. Cette valeur est inférieure à celle qui est proposée pour le Néolithique, mais elle correspond à un territoire géré de manière plus intensive et rationnelle. L'époque romaine, et plus précisément le Haut Empire, coïncident avec une extension considérable du territoire exploité, qui s'étend désormais quasiment à l'ensemble de la zone étudiée (6750 ha). Les IIIe et IVe siècles correspondent à la fois à un relâchement très net de la maille de l'habitat et à la désertion du secteur des collines méridionales (3600 ha). A partir du milieu du Ve siècle, on assiste à une nouvelle phase de densification de l'habitat et d'expansion du territoire exploité, en direction du Nord cette fois (4200 ha).

L'impact sur l'environnement

Enfin, l'évaluation de l'impact de l'homme sur l'environnement constitue un indicateur supplémentaire de la charge démographique et des possibles déséquilibres entre populations et ressources. Les recherches pluridisciplinaires conduites dans la région de Saint-Blaise

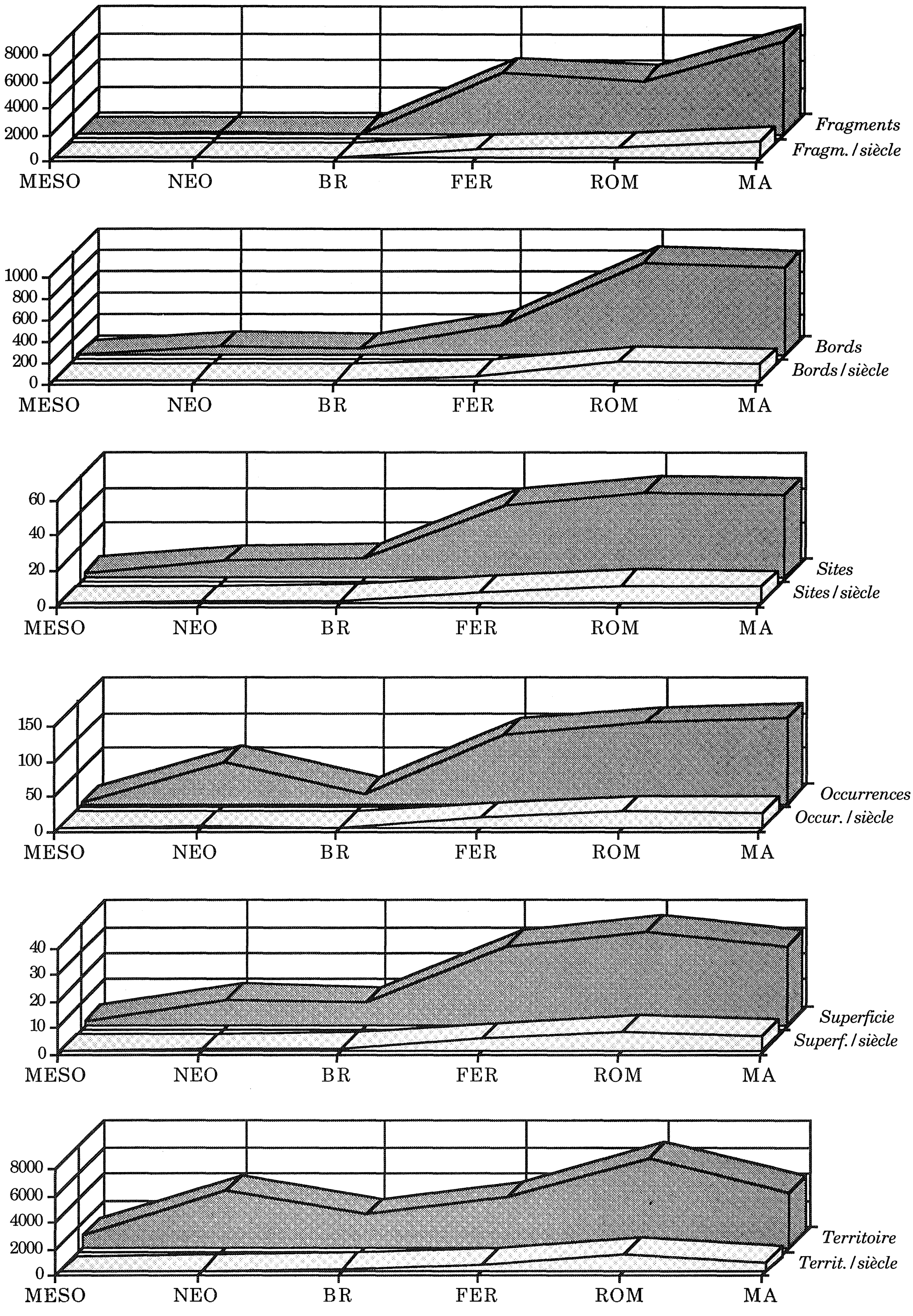

Figure 7.1 Evolution des différents paramètres démographiques par phases culturelles (comparaison des valeurs absolues et des valeurs pondérées par siècle).

ont mis en évidence l'existence de plusieurs phases d'instabilité du milieu, qu'il est possible de corréler avec l'évolution du peuplement (Laval *et al.*, 1992; Trément, 1993; Provansal *et al.*, 1993). Deux crises d'érosion majeures ont laissé leur marque dans le paysage actuel: – la première peut être attribuée en partie à l'intensification des défrichements au Néolithique final; – la seconde, au maximum de population rurale des XVIIIe et XIXe siècles. La longue période intermédiaire se caractérise par une pause érosive qui peut sembler paradoxale. En fait, l'action de l'homme s'exerce alors en profondeur sur le couvert végétal. Durant l'Age du Fer, la proportion de pollens d'arbres chute brusquement de 70 à 40% dans la carotte prélevée dans l'étang du Pourra. Cette mutation radicale du paysage s'accompagne d'un déclin irrémédiable de la chênaie pubescente, d'un effondrement brutal de la courbe de *Pinus* et d'une extension des garrigues. Dans le même temps, les pollens de plantes cultivées se multiplient. Il faut voir là la conséquence d'une extension des défrichements et d'une stabilisation des systèmes agricoles autour des agglomérations protohistoriques. Dans l'Ile de Martigues, l'étude des charbons de bois et des malacofaunes terrestres confirme l'existence d'une flore très dégradée, proche de l'actuelle (Thinon, 1988; Magnin, 1988). On peut admettre que les effets d'un climat moins humide – qui aboutirait dans l'Antiquité romaine à l'assèchement partiel des étangs – ont pu contribuer à gommer l'alourdissement de la charge agricole à l'Age du Fer. Les hommes ont pu également préserver les versants en limitant l'agrosystème aux plateaux calcaires, aux sols légers et plus facilement cultivables. La Crau offrait enfin un potentiel pâturable complémentaire susceptible de limiter la surcharge pastorale (Badan *et al.*, 1995). A l'époque romaine, la chênaie verte subit elle-même un léger recul, peut-être victime à son tour d'une extension des défrichements à des zones jusqu'alors vouées aux garrigues (les versants?). Le secteur des étangs n'a jamais été aussi déboisé. Il faut dire que le développement systématique de l'agrosystème à partir de l'époque augustéenne a bénéficié d'une combinaison de facteurs bio-climatiques, technologiques et historiques favorables à l'extension des cultures dans les zones basses et à une stabilisation des versants. On peut invoquer à la fois la fluctuation 'sèche' du climat antique, l'introduction de nouvelles techniques de drainage et peut-être un renouvellement des plantes et de l'outillage, enfin, mais cela reste à confirmer, la mise en oeuvre d'un système d'armature des versants. Il n'y a donc pas de corrélation simple entre démographie, pression agricole et activité érosive. L'expression sédimentologique des défrichements du Néolithique final et de l'époque moderne a certainement été favorisée par les phases humides du Subboréal et du Petit Age Glaciaire.

ESSAI DE MODELISATION DEMOGRAPHIQUE

La synthèse des critères précédents est susceptible de fournir une image cohérente de l'évolution quantitative du peuplement de la zone étudiée sur la longue durée. Toutefois, l'évolution restituée n'est que relative et toute tentative visant à dépasser ce stade se heurte à un double problème méthodologique: – d'une part, celui de l'échelle de découpage du temps; – d'autre part, celui de l'évaluation du peuplement urbain et du rapport ville/campagne. Ces deux questions seront abordées successivement avant de proposer une modélisation de la dynamique démographique du secteur de Saint-Blaise.

Les modèles d'évolution démographique précédents présentent l'inconvénient d'être basés sur un découpage à la fois hétérogène et trop large du temps. Deux méthodes utilisées conjointement peuvent être proposées pour remédier à ce problème.

Pondération par le facteur Temps

Le premier problème tient au fait que les phases culturelles sur lesquelles s'appuie le découpage chronologique ont une durée très inégale: 5000 ans pour le Mésolithique, 3700 ans pour le Néolithique, 1050 pour l'Age du Bronze, 700 ans pour l'Age du Fer, 500 ans pour l'époque romaine et 550 ans pour le Haut Moyen Age. De plus, la précision obtenue dans la datation des sites prospectés est inversément proportionnelle à la durée de ces différentes périodes. En conséquence, plus la période envisagée est longue, plus la probabilité pour que deux sites (ou plus) soient contemporains est faible. En terme de démographie, cette limite est fondamentale, puisque les cartes archéologiques superposent des séries de sites appartenant en réalité à des séquences chronologiques distinctes. Cette limite est d'autant plus contraignante que l'habitat préhistorique et protohistorique se caractérise par une extrême mobilité jusqu'à l'Age du Fer.

Ces raisons m'ont amené à pondérer les données précédentes par la durée de chaque période considérée et à produire des valeurs moyennes par siècle (Figure 7.2). Le profil des courbes obtenues selon ce mode de calcul ne change pas dans ses grandes lignes. L'Age du Fer apparaît toujours comme un pallier quantitatif décisif. Mais dans le détail, certaines nuances sont susceptibles d'avoir d'importantes conséquences sur le plan démographique, particulièrement en ce qui concerne la Préhistoire. La représentation du Néolithique est ainsi minorée. En revanche, l'Age du Bronze est légèrement mieux représenté en nombre de sites et d'occurrences, ainsi qu'en superficie habitée et exploitée. Ensuite, le rapport entre l'Age du Fer et l'époque romaine doit être révisé au profit de cette dernière. Enfin, la représentation du Haut Moyen Age est globalement minorée par rapport à l'Antiquité.

Resserrement du maillage chronologique

L'image de l'évolution du peuplement du secteur étudié gagne en cohérence une fois les valeurs pondérées par le facteur Temps. Mais elle demeure très générale, avec un

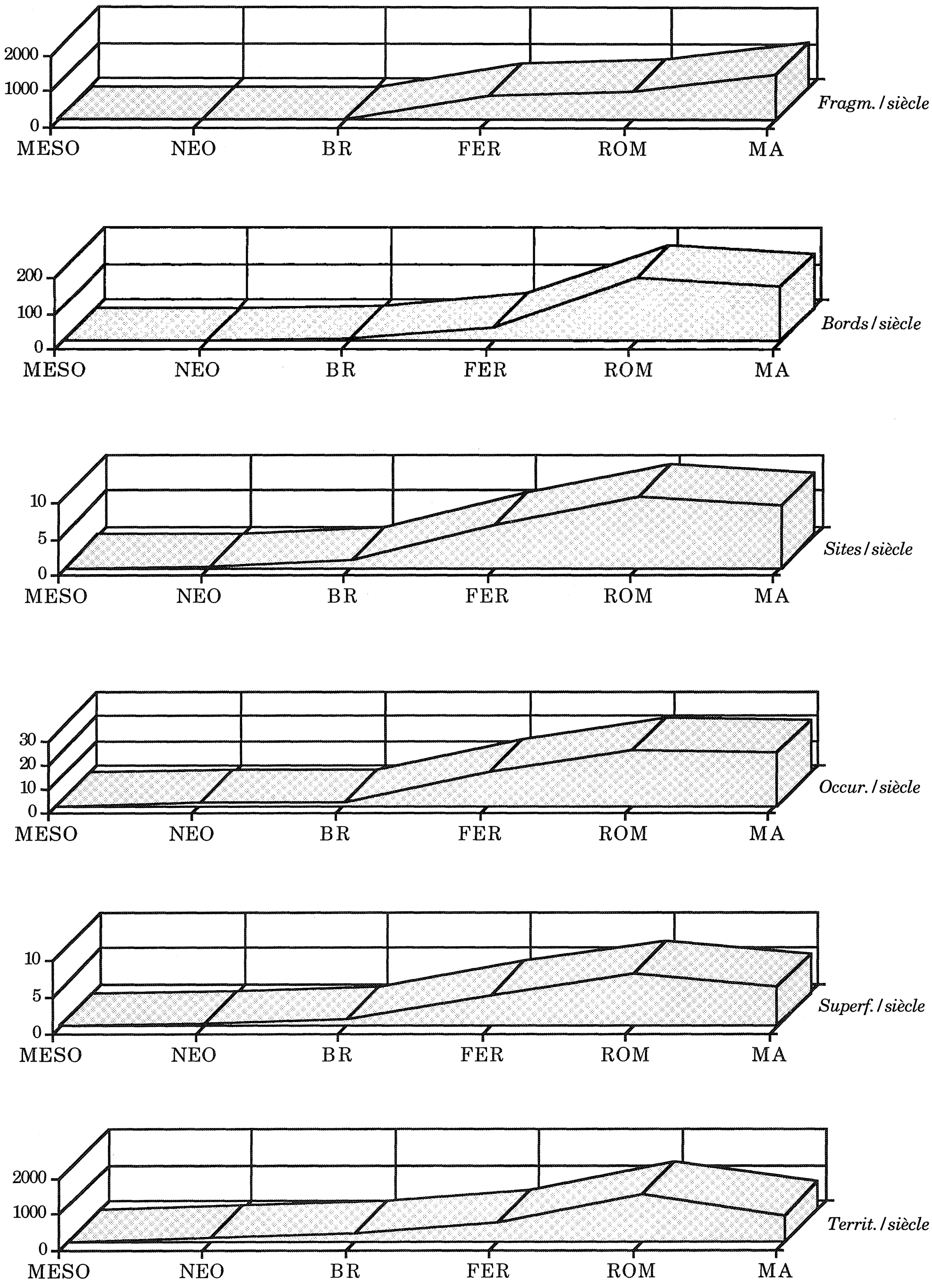

Figure 7.2 Evolution des différents paramètres démographiques par phases culturelles (détail des valeurs pondérées par siècle).

découpage chronologique trop lâche (six phases pour 11500 ans) et une résolution trop faible (1917 ans en moyenne). Il s'avère nécessaire de passer au stade des subdivisions chrono-culturelles. L'opération aboutit à un nouveau découpage en 12 périodes, soit une résolution moyenne de 933 ans (Figure 7.3). Si l'on fait abstraction du Mésolithique, la résolution moyenne passe à 564 ans. Pour la période postérieure au début de l'Age du Fer, elle atteint 242 ans. La pondération des données en fonction de la durée de chaque période (exprimée en siècle) permet d'affiner encore l'image obtenue (Figure 7.4). C'est cette dernière lecture que je retiendrai comme la plus représentative.

Deux phases principales peuvent être distinguées après cette double opération:

- La première phase couvre le Mésolithique, le Néolithique et l'Age du Bronze. Elle est caractérisée par un faible nombre d'artefacts (moins de 17 fragments et bords de céramique par siècle), de sites (moins de 2 par siècle en moyenne) et d'occurrences (moins de 9), par une superficie habitée réduite (moins de 2,3 ha par siècle) et un territoire exploité peu étendu (moins de 714 ha par siècle). Le Néolithique final se distingue toutefois par un léger gonflement du nombre de sites et d'occurrences, ainsi que de la superficie exploitée.
- La seconde phase débute au Premier Age du Fer. Elle se caractérise par un accroissement important, constant sur la longue durée mais irrégulier dans le détail, de tous les paramètres. Trois paliers peuvent être distingués: le Premier Age du Fer, le Haut Empire et le Haut Moyen Age. Ces trois périodes correspondent à des pics de plus en plus élevés dans les courbes exprimant le nombre d'artefacts (respectivement 422, 1629 et 2828 fragments/siècle), de formes (36, 272 et 332 bords/siècle), de sites (8, 18 et 19 sites/siècle) et d'occurrences (17, 41 et 48 occurrences/siècle). La Tène II/III est également très bien représentée en nombre d'artefacts et d'occurrences, ce qui s'explique par la quantité importante de fragments d'amphores italiques recueillis en prospection (2400 fragments). En revanche, la Tène I et le Bas Empire coïncident avec un recul très net de tous les paramètres. La superficie habitée suit une évolution globalement parallèle, bien que le Haut Moyen Age s'inscrive en léger retrait par rapport au Haut Empire (5, 14 et 12 ha/siècle). Enfin, le territoire exploité connaît une extension continue et régulière depuis l'Age du Bronze jusqu'au Haut Empire, passant de 228 à 2700 ha/siècle, avant de se stabiliser autour de 1500 ha/siècle au Bas Empire et au Haut Moyen Age.

La question du peuplement urbain et du rapport ville/campagne

Les modèles d'évolution précédents concernent uniquement le peuplement rural. Le poids démographique des agglomérations protohistoriques et antiques est beaucoup plus délicat à évaluer en l'absence de données historiques. Les fouilles de Saint-Blaise et de l'Ile de Martigues permettent de pallier en partie à cette lacune pour l'Age du Fer, tandis que la pauvreté de la documentation archéologique pour l'époque romaine introduit une grande marge d'incertitude. Une évaluation de la population des agglomérations préromaines peut être tentée sur la base des estimations proposées par Chr. Goudineau (1980: 152) pour les sites de Taradeau et d'Entremont. Sur le premier, l'auteur estime que la soixantaine de cases dégagées devait abriter 3 à 400 individus. Partant de là, et en supposant que toute la superficie *intra muros* d'Entremont était occupée sur le modèle de la 'ville haute' (soit 3,5 ha), et à raison de 4 à 6 personnes par case, la population totale de l'*oppidum* aurait atteint 5 à 8000 âmes. Mais dans la mesure où la trame de l'habitat paraît plus lâche dans la 'ville basse' que dans la 'ville haute', Chr. Goudineau révise ces chiffres sévèrement à la baisse: selon lui, 'un nombre de 2000 à 3000 habitants n'aurait rien d'invraisemblable'. Selon que l'on retient la valeur la plus faible (2000 habitants), les deux valeurs moyennes (3000 et 5000) ou la valeur la plus forte (8000), on est en mesure de calculer une superficie moyenne par habitant (comprise entre 17,5 et 4,4 m^2) susceptible d'être ensuite appliquée à d'autres agglomérations. On obtient ainsi pour Saint-Blaise (5,5 ha) une population respectivement égale à 3135, 4730, 7865 et 12540 habitants. La population du premier village de l'Ile de Martigues (2500 m^2) serait comprise entre 142 et 570 occupants; celle du second village (5000 m^2) entre 284 et 1140 personnes. L'*oppidum* du Castellan (1 ha) aurait abrité entre 568 et 2280 personnes. Deux observations permettent de préciser ces estimations encore très générales: – d'une part, la trame de l'habitat n'est pas homogène d'un site à l'autre, et à l'intérieur d'un même site: rien ne rappelle à Saint-Blaise le caractère 'concentrationnaire' de l'habitat de l'Ile; – d'autre part, tout indique que la densité de population a varié au cours de l'Age du Fer au sein de ces agglomérations. Pour Saint-Blaise, je retiendrai par conséquent les deux valeurs inférieures: la plus basse pour le Premier Age du Fer; la seconde pour le Deuxième. La population serait ainsi passée de 3000 occupants au VIe siècle à presque 5000 au IIe. Les valeurs intermédiaires conviennent mieux au village de l'Ile de Martigues, dont le nombre d'habitants serait passé de 150 au Ve siècle à plus de 200 à la fin du IIIe, pour atteindre 300 dans le courant du IIe. Sur cette base, on peut estimer que la population des agglomérations de la rive occidentale de l'étang de Berre atteignait 3 à 4000 occupants au VIe siècle et durant une partie du Ve; aux IVe et IIIe siècles, ce nombre diminue probablement de manière conséquente; au IIe siècle, la restructuration des agglomérations correspondrait à une nouvelle pression de la population 'proto-urbaine', qui s'établirait autour de 5 à 6000 âmes.

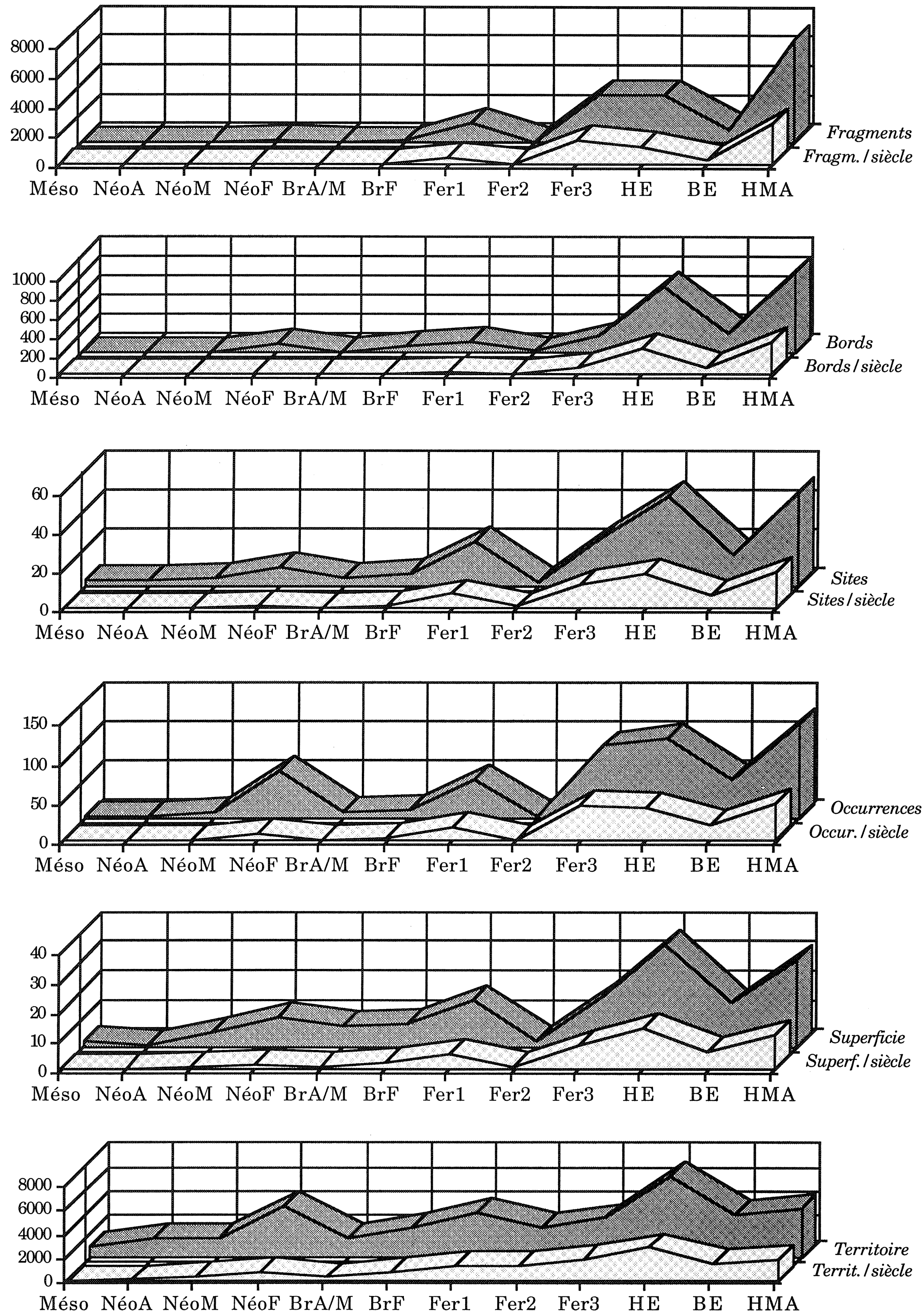

Figure 7.3 Evolution des différents paramètres démographiques par subdivisions chrono-culturelles (comparaison des valeurs absolues et des valeurs pondérées par siècle).

SYNTHESE: DU PEUPLEMENT A LA DEMOGRAPHIE

A ce stade de la réflexion, il convient de proposer, pour le secteur étudié, un modèle d'évolution démographique qui tienne compte à la fois du peuplement des villes, des agglomérations et des campagnes.

Le peuplement préhistorique (du Mésolithique à l'Age du Bronze)

La rive occidentale de l'étang de Berre reste faiblement peuplée jusqu'au Chasséen. Selon M. Escalon de Fonton (1968), les dimensions remarquables de l'Abri Cornille lui permettaient d'accueillir 'plusieurs dizaines d'occupants'. On peut donc supposer que l'effectif des groupes mésolithiques qui occupaient les trois abris principaux n'excédait guère la centaine. Un palier est franchi au Chasséen, mais surtout, la situation change radicalement au Néolithique final, avec le développement du village de Miouvin et la multiplication des indices d'activité dans le secteur des étangs (Figure 7.5). Cette période coïncide avec une première crise érosive localement dommageable pour l'équilibre du milieu, dont les causes sont à rechercher autant dans la péjoration climatique subboréale que dans une surcharge agro-pastorale. Pour autant, l'image d'un essor démographique doit être nuancée, compte tenu de la durée de la période considérée et de la forte mobilité de l'habitat. Une fois pondérés, les critères démographiques analysés indiquent une légère augmentation du nombre de sites et surtout d'occurrences, ainsi qu'une extension sensible de la surface habitée et du territoire exploité. On peut estimer la population du secteur étudié à plusieurs centaines d'individus, voire un millier. Le Bronze Ancien et Moyen s'inscrit en retrait. Le peuplement se regroupe sur les hauteurs en quelques points. Au Bronze final, ce schéma de peuplement évolue avec une tendance au déperchement et l'apparition d'un habitat à caractère palafittique. On constate alors une reprise de tous les paramètres démographiques, dont les valeurs, une fois pondérées, concurrencent voire même dépassent celles du Néolithique final.

Le peuplement de l'Age du Fer (fin VIIe-Ier siècle avant J.C.)

L'Age du Fer apparaît comme une étape essentielle dans l'évolution du peuplement du secteur étudié: contrairement au Néolithique final, dont la pression démographique semble avoir été relativement limitée dans le temps et dans l'espace, il initie une tendance nouvelle caractérisée par un gonflement continu et soutenu jusqu'à l'aube du Moyen Age, et cela malgré des accidents. Le Premier Age du Fer correspond à une augmentation considérable de tous les paramètres démographiques: par rapport au Bronze final, et après pondération, le nombre de sites est multiplié par 3,8, le nombre d'occurrences par 5,9, le nombre d'artefacts par 26, le nombre de formes de céramiques par 2,2, la superficie habitée par 2,3 et le territoire exploité par 1,7 (Figure 7.6). Après le vide énigmatique des IVe et IIIe siècles, on constate un nouvel essor de ces mêmes paramètres: le nombre de sites occupés à la Tène II et surtout à la Tène III est multiplié par 1,6, le nombre d'occurrences par 2,8, le nombre d'artefacts par 3,9, le nombre de formes de céramiques par 2,2, la superficie habitée par 1,6 et le territoire exploité par 1,3. Cette évolution suit fidèlement celle des agglomérations, qui contrôlent désormais strictement l'exploitation des terroirs, abritent une partie des paysans, des activités de transformation et de stockage et gèrent la commercialisation des éventuels surplus de production. On peut supposer que la population totale était alors comprise entre 5 et 7000 habitants. Cette évolution s'expliquerait par la prospérité de l'économie locale, qui développe exceptionnellement tôt une oléiculture et une viticulture, et qui se manifeste dans l'édification d'une somptueuse parure monumentale à Saint-Blaise. Elle expliquerait, localement, des déséquilibres dans l'approvisionnement en viande et en coquillages (Chausserie-Laprée *et al.*, 1988); à une échelle plus large, elle serait responsable des vastes défrichements qui transforment le paysage de manière irréversible.

Le peuplement gallo-romain (Ier-Ve siècle de notre ère)

Il est impossible, dans l'état actuel des recherches, de proposer la moindre hypothèse relative au peuplement des agglomérations de Fos et de Martigues à l'époque romaine. Il n'est même pas certain, à l'échelle du secteur étudié, que la population de ces deux nouveaux centres ait été supérieure ou même égale à celle des agglomérations protohistoriques, comme le voudrait la vraisemblance historique. En revanche, la population dispersée dans la campagne sur les lieux de production est nettement plus abondante qu'à l'époque précédente: le nombre de sites, une fois pondéré, est multiplié par 1,5; la superficie habitée et le territoire exploité par 1,6 (Figure 7.7). Cette évolution s'opère précocément, dès la fin du Ier siècle avant J.C. Le maximum du peuplement rural est atteint au siècle suivant. Si l'on considère, sur le modèle observé dans la fouille des Soires (Trément, 1997), que les petites implantations correspondent à des exploitations familiales, on peut estimer, à raison de 8 personnes par établissement, leur population totale à près de 300 personnes; si l'on suppose aux gros établissements une population de 15 personnes et que l'on élève ce nombre à 30 ou 40 pour les exploitations domaniales de type *villa* (Congès *et al.*, 1994: 285; Leveau *et al.*, 1993b: 143), on obtient une population rurale de 5 à 600 personnes au minimum. Or seulement 21,5% de l'espace étudié a été prospecté. On peut par conséquent raisonnablement tabler sur une population 4 à 5 fois supérieure, soit 2000 à 3000 personnes vivant dans la

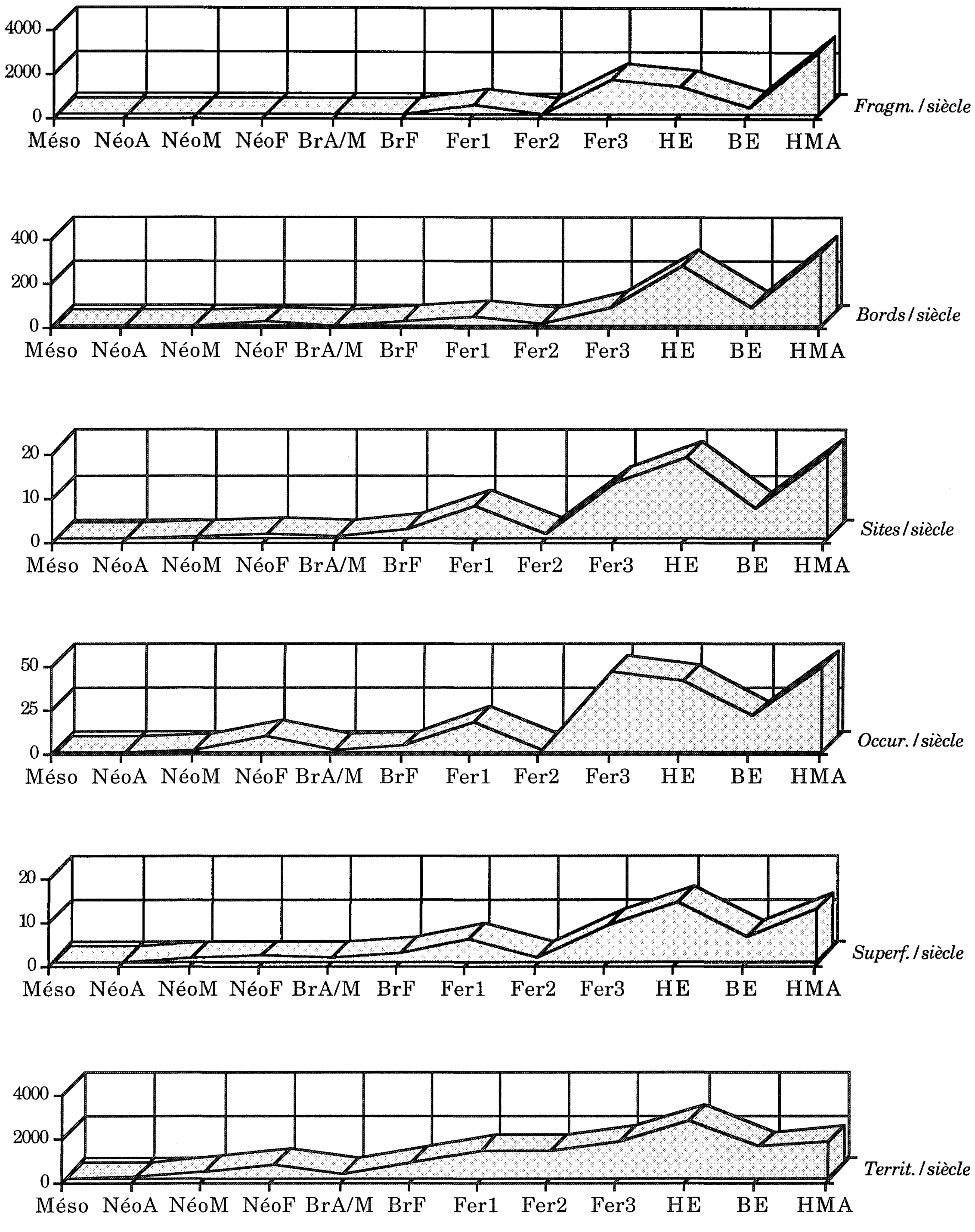

Figure 7.4 Evolution des différents paramètres démographiques par subdivisions chrono-culturelles (détail des valeurs pondérées par siècle).

campagne. L'extension des surfaces cultivées peut s'expliquer autant par un gonflement de la population (endogène? exogène?) que par le passage à une véritable économie de production pour la commercialisation, dépendante de marchés désormais extérieurs et nécessitant une intensification de la mise en valeur des terroirs. Toutefois, on peut supposer que l'abandon des anciennes agglomérations protohistoriques s'est accompagné d'une dispersion des populations dans les campagnes environnantes.

Dès le milieu du IIe siècle s'opère une rapide décrue de l'habitat dispersé, dont la densité stagne à un niveau très bas du début du IIIe siècle au milieu du Ve (Figure 7.8). Le nombre pondéré de sites est divisé par 2,7, le

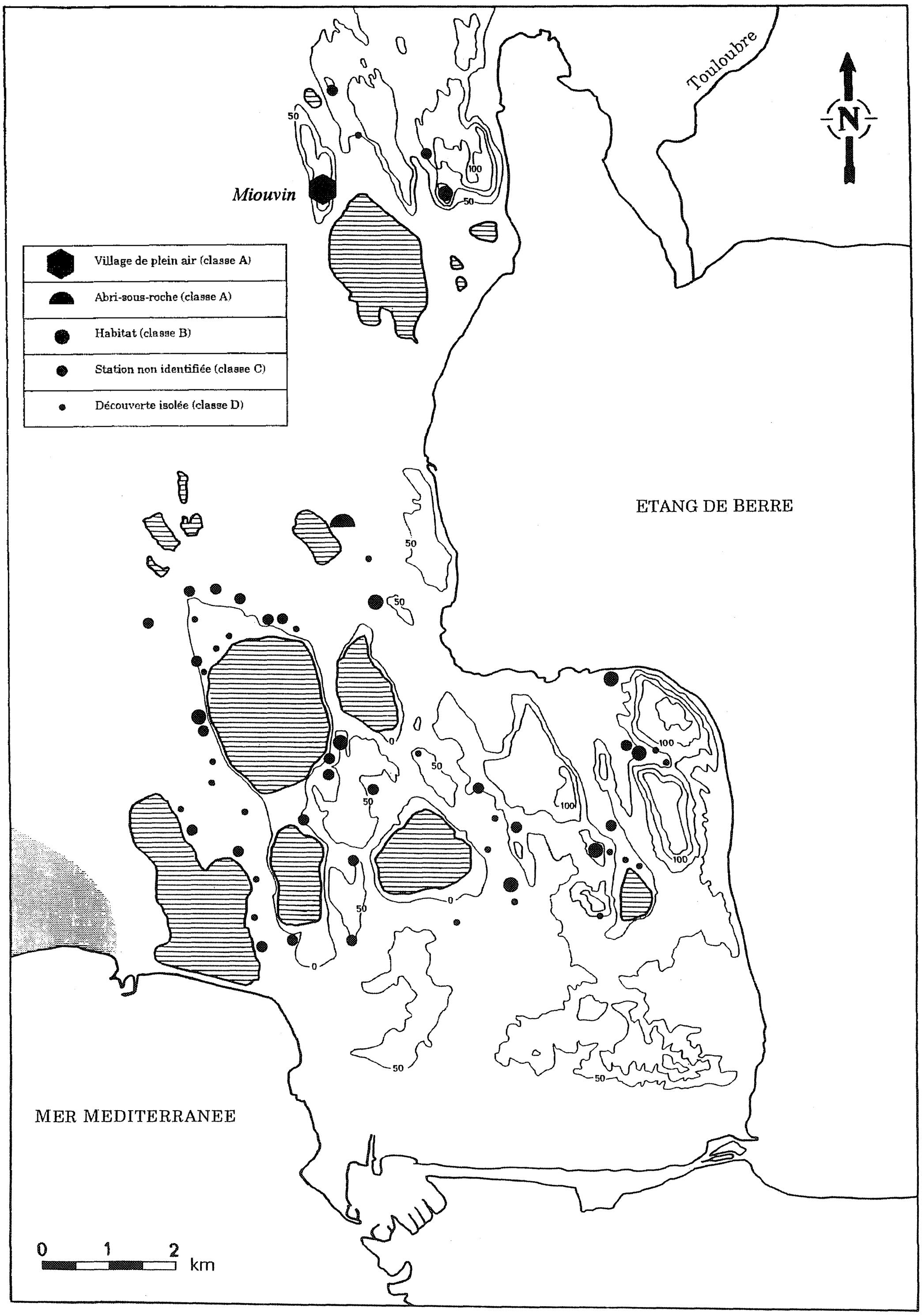

Figure 7.5 Le secteur de Saint-Blaise au Néolithique final.

nombre d'occurrences par 2, le nombre d'artefacts par 3,8, la superficie habitée par 2,3 et le territoire exploité par 1,9. Seules les *villae* et les gros établissements agricoles se maintiennent. On peut envisager une concentration foncière, peut-être favorisée par un déclin démographique.

Le peuplement alto-médiéval (Ve-VIIe siècle de notre ère)

A partir du milieu du Ve siècle s'opère une nouvelle densification de l'occupation du sol que l'on ne peut s'empêcher de mettre en rapport avec une poussée

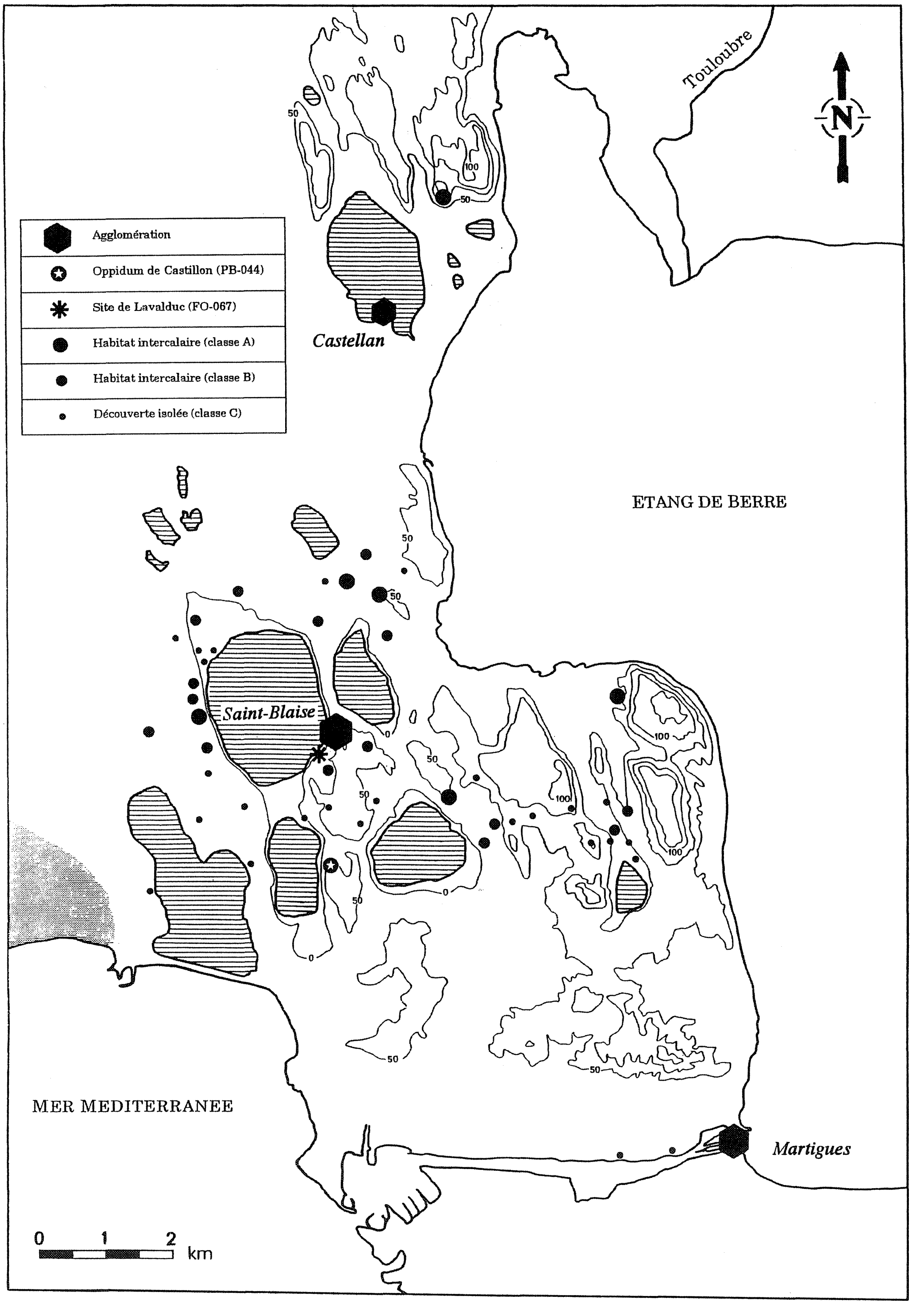

Figure 7.6 Le secteur de Saint-Blaise au Premier Age du Fer.

démographique, peut-être locale (Figure 7.9). On constate en effet un triple phénomène: – d'une part, une forte continuité de l'occupation sur les pôles d'habitat de l'époque romaine: Fos et Martigues; – d'autre part, l'émergence d'agglomérations perchées: Saint-Blaise, Saint-Michel, Toti; – enfin, la mise en place, par vagues successives, d'un habitat dispersé dont les caractéristiques et la densité ne sont pas sans rappeler celui du Haut Empire, bien que la superficie moyenne des sites soit généralement inférieure et que les regroupements en hameaux soient plus fréquents. Du point de vue démographique, la question principale est

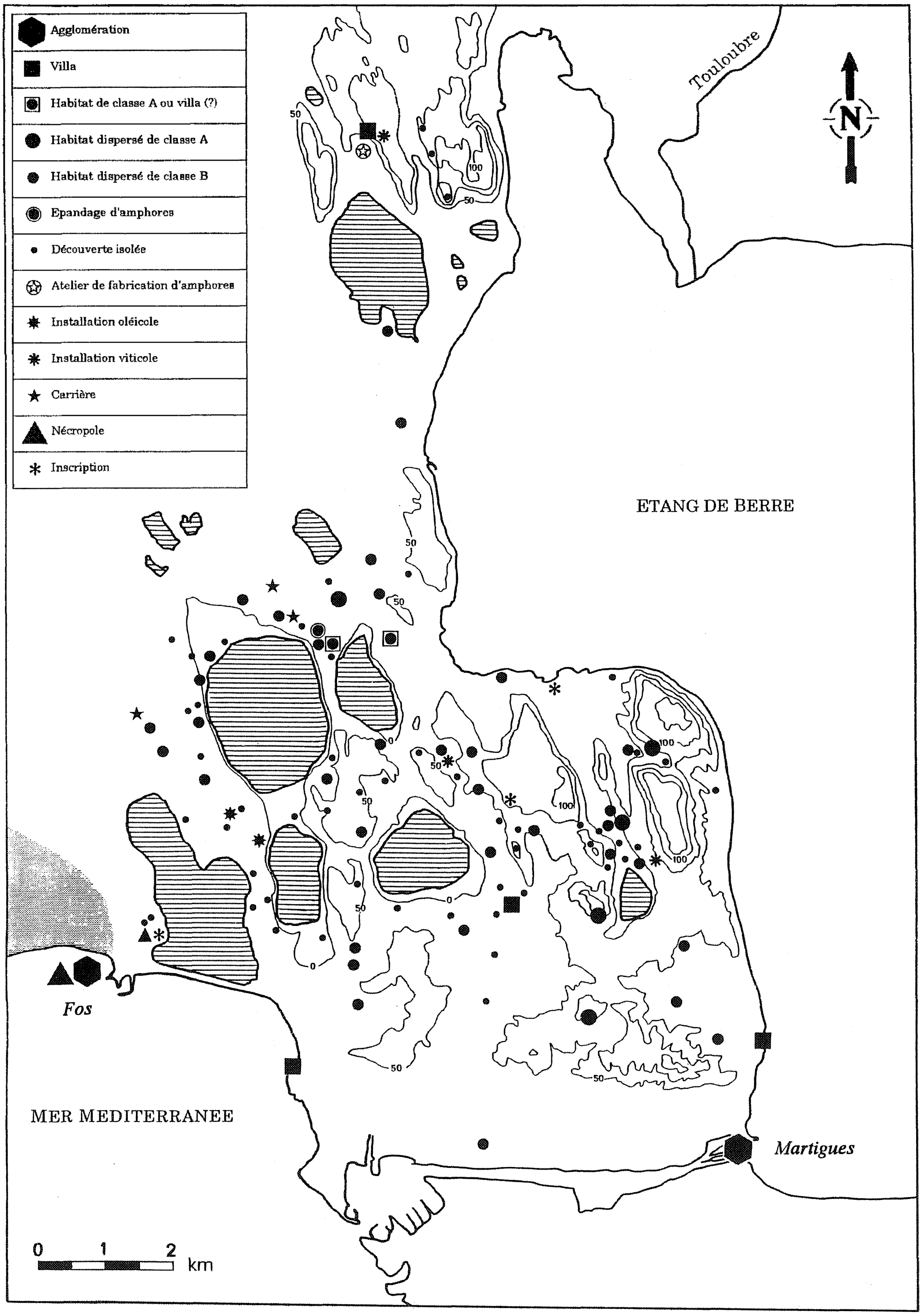

Figure 7.7 Le secteur de Saint-Blaise aux Ier et IIe siècles de notre ère.

de savoir si la 'concentration' de ce phénomène complexe dans une fourchette de temps comprise entre le milieu du Ve siècle et le début du VIIe n'est pas le résultat, artificiel, d'un biais méthodologique dû à notre méconnaissance actuelle des céramiques grises de la fin de l'Antiquité et du Haut Moyen Age. L'étude des lieux de sépulture montre pour sa part une plus grande dispersion chronologique, entre le Ve et le XIe siècle. Or le lien entre les cimetières et l'habitat a été parfaitement établi. Du même coup, il faudrait envisager un 'étalement' des découvertes de cette période sur un laps de temps plus important, ce qui ne serait pas sans conséquence sur le plan démographique, dans le sens d'une densité de population moindre mais d'une plus forte continuité entre l'Antiquité et le Moyen Age.

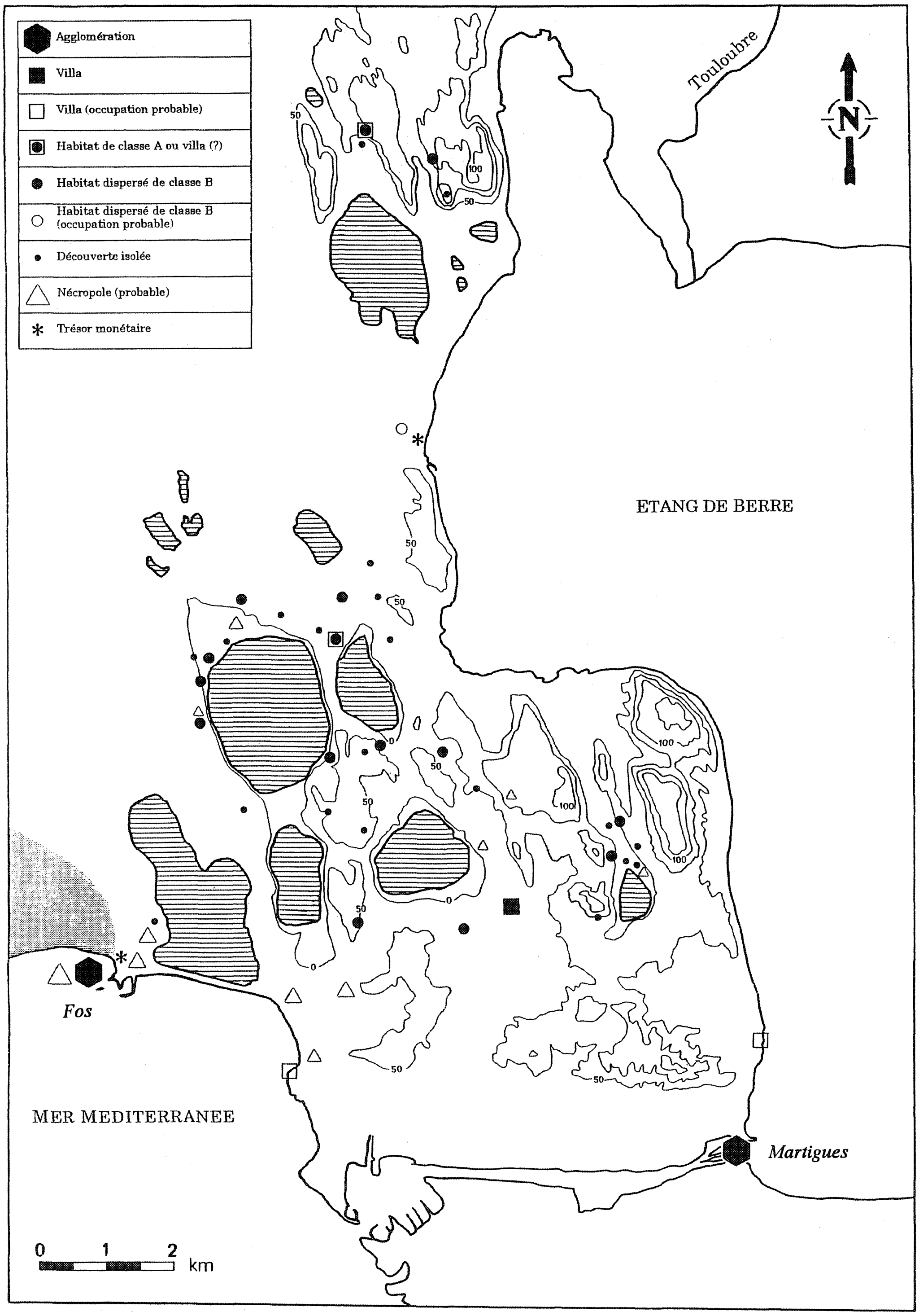

Figure 7.8 Le secteur de Saint-Blaise aux IIIe et IVe siècles de notre ère

LE PEUPLEMENT LOCAL DANS LA DYNAMIQUE DEMOGRAPHIQUE REGIONALE

Il convient, à ce stade de la recherche, de déterminer dans quelle mesure l'évolution restituée peut servir de modèle à une échelle plus large, et de définir les spécificités de l'aire géographique étudiée. Les éléments de comparaison sont plutôt rares en Provence. 25 zones prospectées ces dernières années ont été identifiées (Figure 7.10). Cette liste ne prétend pas constituer un état de la recherche. Elle est très hétérogène, et cela à divers points de vue:

– La distribution des prospections est inégale: 10 dans le Var, 5 dans les Alpes-de-Haute-Provence, 4 dans les Bouches-du-Rhône, 3 dans le Vaucluse, une dans les Hautes-Alpes et aucune dans les Alpes-Maritimes.

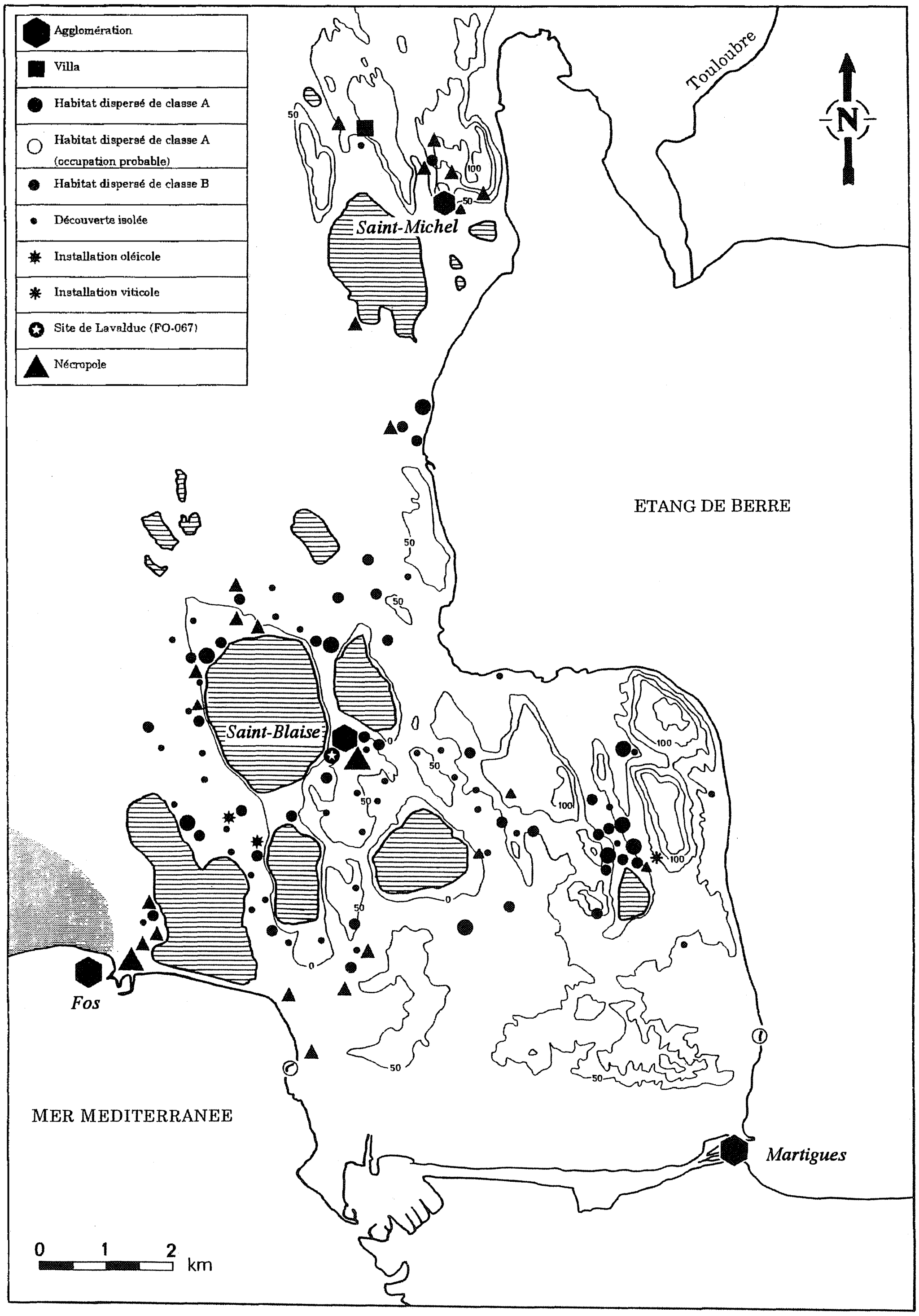

Figure 7.9 Le secteur de Saint-Blaise aux Ve et VIe siècles de notre ère.

Les régions montagneuses, au nord et à l'est, ne sont pratiquement pas couvertes.

– Le type et l'intensité des prospections varient également beaucoup d'un secteur à l'autre. Les prospections systématiques concernent principalement les Bouches-du-Rhône et le Var. Des inventaires communaux ont été lancés par le Service Régional de l'Archéologie dans les Alpes-de-Haute-Provence, par le Centre de Documentation Archéologique du Var et par le Service d'Archéologie du Vaucluse. Les travaux d'amateurs sont plus difficilement utilisables. Le nombre de sites identifiés tient par conséquent autant à l'intensité de la recherche qu'à la densité réelle du peuplement.

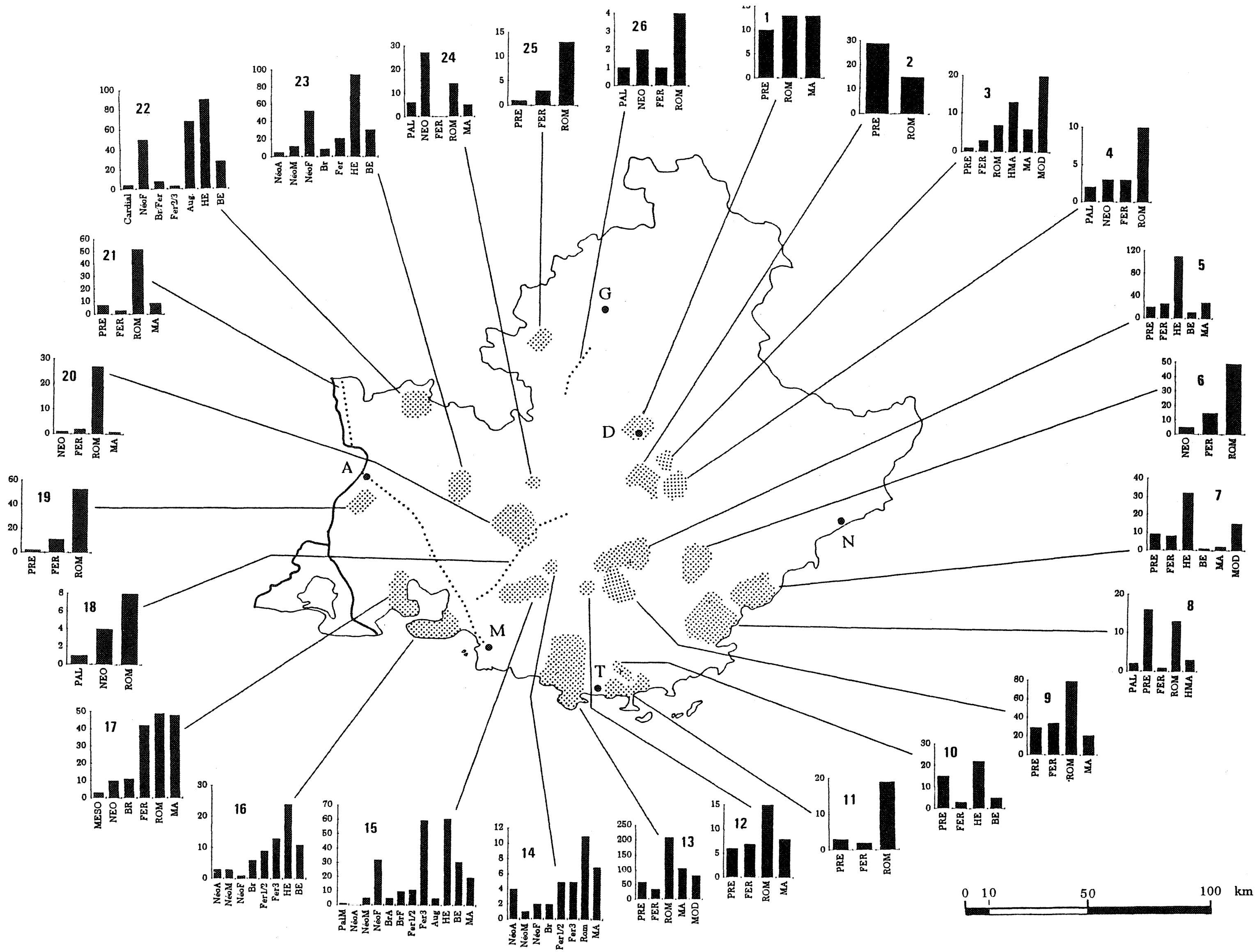

Figure 7.10 Evolution comparée du peuplement dans 26 secteurs de Provence (nombre de sites recensés en prospection).

1: Digne-les-Bains (04) (Gallice et al., *1994) – 2: Vallée de l'Estoublaïsse (04) (Stouvenot, 1992) – 3: Vallée de l'Asse (04) (Stouvenot, 1994) – 4: Asse de Blieux (04) (Stouvenot* et al., *1993) – 5: Haut-Var Nord (83) (Michel, 1993b) – 6: Les Maures-Nord (83) (Bertoncello, 1994) – 7: Fréjus (83) (Cameron* et al., *1994) – 8: Les Maures-Sud (83) (Gazenbeek, 1994) – 9: Haut-Var Sud (83) (Michel, 1992) – 10: Vallée de Sauvebonne (83) (Borréani, 1993) – 11: Hyères (83) (Borréani* et al., *1994) – 12: Canal de Provence-Brue-Auriac (83) (Michel, 1993a) – 13: Var occidental (83) (Delattre* et al., *1994) – 14: Rians (83) (Borréani, 1994) – 15: Massif de Sainte-Victoire (13) (D'Anna* et al., *1993, 1994) – 16: Chaîne de la Nerthe (13) (Gateau, 1993) – 17: Secteur de Saint-Blaise (13) (Trément, 1994) – 18: Gazoduc Cabriès-Manosque (13/84/04) (Peyric, 1992) – 19: Cantons de Châteaurenard et Tarascon (13) (Ferrando, 1994) – 20: Pays d'Aigues (84) (Chemin, 1993) – 21: TGV-Méditerranée (13/84) (Mocci, 1991) – 22: Vaisonnais (84) (Meffre, 1994) – 23: Vallée du Calavon (84) (Bellet dir., 1990) – 24: Mâne (04) (Gallice* et al., *1994) – 25: La Bâtie-Montsaléon (05) (Chemin* et al., *1994) – 26: Autoroute Sisteron-La Saulce (04/05) (Guillaume, 1994).*

– Enfin, la qualité de l'information chronologique est très variable.

Rythmes démographiques

De l'observation des 26 histogrammes de la Figure 7.10, il est possible de mettre en évidence une tendance générale dans l'évolution du peuplement en Provence. A l'image de ce qui est observé sur la rive occidentale de l'étang de Berre, la Préhistoire est essentiellement attestée par le Néolithique, et plus précisément le Néolithique final, qui est bien représenté dans 16 des 26 secteurs échantillonnés. On a vu qu'il convient de pondérer l'importance de cette période, qui est sur-représentée du fait de sa durée. Toutefois, les premiers résultats de l'opération archéologique conduite sur le tracé du TGV-Méditerranée montrent que l'occupation néolithique a été sous-estimée par les prospections dans la basse et moyenne vallée du Rhône (Mocci, 1991).

L'Age du Bronze n'apparaît qu'exceptionnellement dans les histogrammes: sur les rives de l'étang de Berre, dans la chaîne de la Sainte-Victoire et, immédiatement à l'est, à Rians, dans la vallée du Calavon et en Vaisonnais. Encore est-il le plus souvent très minoritaire en regard des périodes qui l'encadrent. Cela tient pour une part à la qualité des prospections et à des problèmes d'identification des traceurs chrono-culturels. Mais la rareté des fouilles relatives à cette longue période va dans le sens d'un recul généralisé du peuplement en Provence. Il reste toutefois à en évaluer l'ampleur.

Plus surprenant, l'Age du Fer n'est représenté de manière significative que dans six histogrammes correspondant à trois secteurs géographiques voisins: les rives occidentale et méridionale de l'étang de Berre, le secteur de la Sainte-Victoire et le Haut-Var. On ne peut s'empêcher d'établir un lien entre leur localisation et la proximité du territoire de Marseille. Dans le secteur de Saint-Blaise et dans la chaîne de la Nerthe (Gateau, 1993), le lien entre l'apparition des premières agglomérations, la diffusion d'un petit habitat dispersé et le commerce méditerranéen est évident. Une autre observation d'importance tient aux décalages chronologiques constatés, d'un secteur à l'autre, dans le développement des agglomérations indigènes et plus généralement dans la densification de l'occupation du sol à l'Age du Fer. Les plus anciennes agglomérations connues en Gaule apparaissent précisément sur les rives ouest et sud de l'étang de Berre, dès la fin du VIIe siècle. Le phénomène semble se diffuser dans un premier temps sur le littoral, à l'ouest et à l'est, dans le courant du VIe siècle, puis dans l'arrière-pays au siècle suivant. Le rôle de Marseille a été mis au premier plan; il n'est pas question de le discuter ici. Ce qui importe est que ce mouvement est la conséquence d'une véritable pression démographique. Les prospections conduites dans l'arrière-pays provençal font apparaître une densification beaucoup moins importante de l'habitat entre le Bronze final et le Premier Age du Fer (Bellet *dir.*, 1990: 31–3; Buisson-Catil, 1991; Rossi, 1993; Arcelin, 1992: 308). Plus près de l'étang de Berre, les recherches menées sur le piémont méridional de la Sainte-Victoire soulignent la prépondérance du Deuxième Age du Fer (D'Anna *et al.*, 1993; 1994). Il est donc probable qu'au Premier Age du Fer les comportements démographiques aient été encore très différenciés d'une région à l'autre et déterminés avant tout par les évolutions socio-économiques locales (Arcelin, 1989: 64).

Autre constante provençale, le 'silence archéologique' des IVe et IIIe siècles avant J.C. prendrait un double sens dans cette perspective: – les secteurs où l'économie et le peuplement se sont développés précocément étaient plus sensibles aux fluctuations des échanges commerciaux et de plus en plus tributaires de la politique massaliote; plus vulnérables par conséquent à une éventuelle crise; – ailleurs, ce 'vide' (relatif) constituerait simplement le prolongement d'un bas niveau de peuplement hérité des périodes antérieures. Des agglomérations existent – c'est le cas du village de l'Ile de Martigues – mais elles sont relativement peu nombreuses (tout au moins en Provence) et n'ont pas les dimensions de celles qui se développent à la période suivante.

La rupture observée au début du IIe siècle s'opère à une échelle beaucoup plus large, qui a toutes les chances de correspondre à une évolution démographique: en témoignent, tant en Provence qu'en Languedoc, à la fois l'apparition de nouvelles agglomérations et la restructuration de celles qui existent déjà – le plus souvent dans le sens d'une extension de la superficie habitée. Certes, ce phénomène fait suite à une série de destructions ou d'abandons en Basse Provence. D'autre part, la réorganisation des trames habitées s'opère bien souvent au profit d'une plus grande spécialisation fonctionnelle de l'espace. Que l'on songe à la 'ville basse' d'Entremont II, où l'agrandissement et la complexification des maisons se font en partie au bénéfice des activités artisanales. P. Arcelin (1986: 67; 1992: 325–6) écarte même l'hypothèse d'une évolution démographique au profit de celle d'un regroupement de populations jusqu'alors dispersées dans les campagnes. Le problème est qu'aucune des prospections conduites en Provence et en Languedoc n'a mis en évidence l'existence d'un habitat dispersé daté de la Tène I. En revanche, les deux siècles précédant le changement d'ère apparaissent comme une période de création de sites dans le massif de Sainte-Victoire (Mocci *et al.*, 1991), dans les Maures septentrionales (Bertoncello 1994) et dans le Briançonnais (Rossi, 1993). Or, précisément, le Premier Age du Fer était très peu représenté dans ces secteurs.

Autre constante, la lacune du Ier siècle avant J.C. tient autant, dans la région de Marseille, à l'abandon de bon nombre d'*oppida* au moment de la conquête qu'à des problèmes de définition des traceurs chronologiques. Dans les différentes zones prospectées, l'habitat dispersé attribué un peu facilement aux IIe et Ier siècles avant J.C. sur la foi de la chronologie des amphores italiques

est vraisemblablement tardif. L'hypothèse d'un habitat dispersé dense contemporain des agglomérations du IIe siècle présenterait un double inconvénient: – d'une part, celui d'impliquer un niveau de peuplement encore plus important à cette époque, suivi d'un vide à peu près complet jusqu'à la période augustéenne; – d'autre part, celui d'aller à l'encontre de l'idée d'une concentration des populations et des activités au sein de ces mêmes agglomérations au IIe siècle. L'hypothèse la plus simple et la plus logique est de considérer que, là où les agglomérations ont été abandonnées, les populations se sont dispersées dans la campagne environnante.

Dans le secteur de Saint-Blaise, l'époque augustéenne correspond à une densification considérable de l'habitat dispersé. Il en va de même en Languedoc oriental, dans le Vaucluse et dans le Var. Partout, le Ier siècle correspond à un maximum démographique en milieu rural et vraisemblablement à un maximum absolu du peuplement dans la plupart des régions avant l'époque moderne. La question reste de savoir si cette évolution correspond vraiment à un essor démographique, auquel des apports de population ont pu ajouter leurs effets, ou bien si elle ne s'inscrit pas plutôt dans la continuité de l'expansion démographique initiée dans le courant de l'Age du Fer. A propos du territoire de Lunel-Viel, les auteurs des prospections évoquent un 'essor démographique' (Favory *et al.*, 1994: 217). Pour l'Italie des deux premiers siècles de notre ère, E. Lo Cascio (1994: 114) envisage également 'una consistente pressione demografica'. En Afrique du Nord, J.-M. Lassère (1977: 30) conclut à un 'réel progrès démographique'.

Le Bas Empire coïncide avec un recul généralisé de l'habitat dispersé. Les recherches récentes soulignent la précocité de ce phénomène. Sur la rive occidentale de l'étang de Berre, on peut en situer le début dans le courant du second tiers du IIe siècle. Les *villae* semblent mieux résister, jusqu'au milieu du IIIe siècle. En Beaucairois, 34% seulement des sites du Haut Empire restent occupés au IIIe siècle (Bessac *et al.,* 1987: 103). En Lunellois (Favory *et al.*, 1994: 217) et en Vaisonnais (Meffre 1994: 123), plus de la moitié des sites disparaissent avant la fin du IIe siècle ou le début du IIIe. Un processus plus radical encore est observé en Vaunage (Parodi *et al.*, 1987: 8). Dans les Maures, 60% des sites sont abandonnés dès la fin du Haut-Empire (Bertoncello, 1994: 222). L'habitat dispersé paraît mieux résister dans la vallée du Calavon (Bellet *dir.*, 1990: 47). Les auteurs des différentes prospections reprennent à leur compte l'hypothèse d'un 'recalibrage de l'habitat et de l'exploitation du sol avec peut-être des regroupements de population et/ou des concentrations foncières' (Favory *et al.*, 1994: 217–8). Celle-ci n'en reste pas moins à démontrer archéologiquement. D'autres pistes doivent être explorées. La peste qui sévit en Europe à partir de la seconde moitié du IIe siècle n'est probablement pas pour rien dans le dépeuplement apparent des campagnes (Lo Cascio, 1994: 123–5). R.J. et M.L. Littman (1973: 243–55) estiment que la 'peste antonine' a décimé 20% de la population de l'Empire. L'argument épidémiologique a été utilisé pour expliquer les fluctuations de l'occupation du sol dans la vallée de l'Albegna (Cambi *et al.*, 1989).

L'évolution observée à partir du milieu du Ve siècle sur la rive occidentale de l'étang de Berre n'a, à ma connaissance, aucun équivalent en Provence. Tout indique en effet une densification importante du peuplement, à l'image de ce qui a été observé dès le IVe siècle en Andalousie occidentale, dans la région de Séville (Ruiz Delgado, 1985). Dans la basse vallée de l'Arc, il semble que les zones basses et les piémonts soient désertés au profit d'établissements de hauteur (Leveau *et al.*, 1993a: 202). En Lunellois, 67% des établissements sont abandonnés durant cette période et aucune nouvelle implantation n'est constatée. Les auteurs mettent cette évolution en rapport avec un possible regroupement de populations dispersées au sein du village de Lunel-Viel, qui se renforce alors (Favory *et al.*, 1994: 218). En Vaunage, l'essentiel des abandons a eu lieu dans le courant des IIIe et IVe siècles (Parodi *et al.*, 1987). En Vaisonnais, 27% des sites occupés durant le Haut Empire perdurent jusqu'à la fin de l'Antiquité et 15% jusqu'au Haut Moyen Age (Meffre, 1994: 123). Dans la vallée du Calavon, les prospections ont révélé une occupation tardive assez dense: en effet, 31 sites sont occupés aux Ve et VIe siècles, contre 95 au Haut Empire (Bellet *dir.*, 1990: 47). La même situation prévaut dans la chaîne de la Nerthe, au sud de l'étang de Berre: les *villae* y perdurent jusqu'au IVe siècle au moins, mais quatre d'entre elles sont encore occupées au Ve siècle et trois au siècle suivant (Gateau, 1993: 156–7). Il est possible, enfin, qu'un habitat dispersé se maintienne tardivement en Camargue (Rigoir, 1960: 15–6). Les premiers résultats du programme mis en place sur le delta du Rhône par le Service Régional de l'Archéologie soulignent l'abondance des sites de l'Antiquité tardive (Arnaud-Fassetta , 1997). Ceux-ci sont massivement abandonnés dans le courant du Haut Moyen Age.

Répartitions et densités: De la densité de l'habitat à la densité de la population

Les comparaisons qui précèdent sont basées sur des évolutions relatives du peuplement à travers le temps. L'estimation, pour chaque période, de la densité réelle de la population dans les différents secteurs considérés donnerait une image plus précise de sa répartition géographique, permettant une meilleure compréhension de l'interaction des différentes échelles spatiales dans la dynamique démographique régionale. Mais on a vu que, même dans les zones où les prospections ont été particulièrement intensives, il est quasiment impossible de proposer des estimations du peuplement en valeur absolue. En particulier, le rapport entre population urbaine et population rurale est difficile à établir, et il faut se

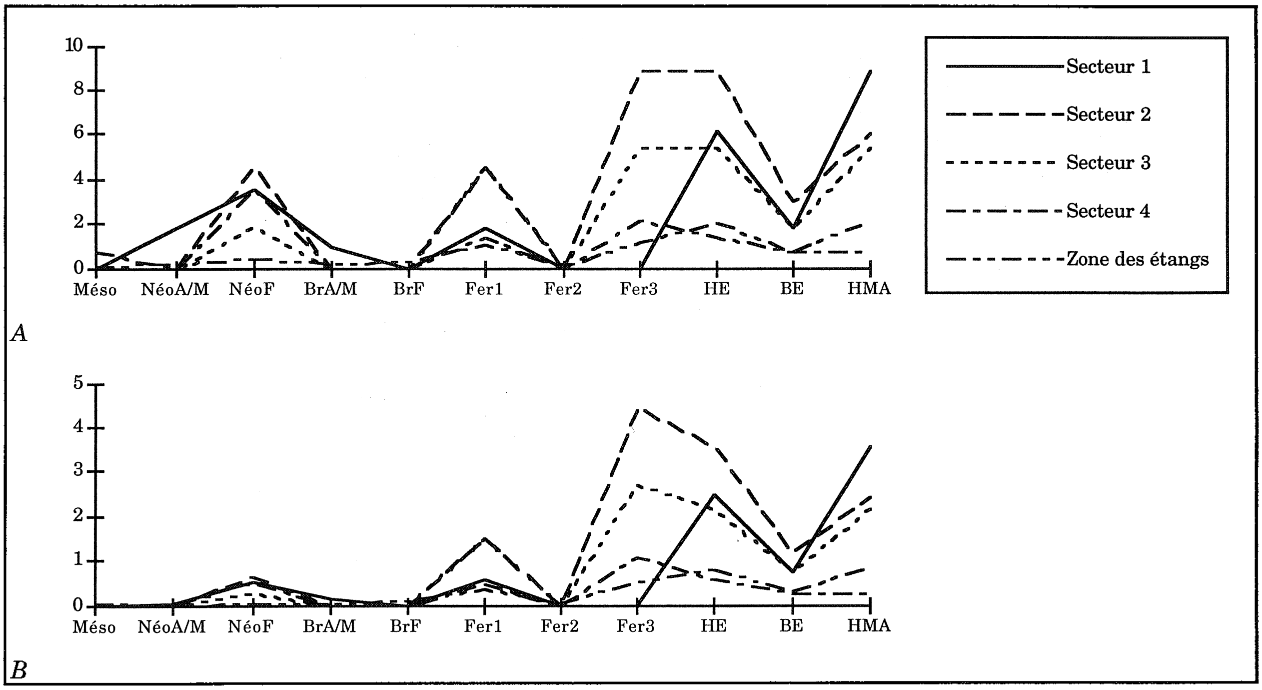

Figure 7.11 Densité de l'habitat au kilomètre carré dans quatre secteurs de la région de Saint-Blaise prospectés systématiquement - A: valeurs absolues - B: valeurs pondérées par siècle.
Secteur 1: Vallon de Magrignane (112 ha) – Secteur 2: Vallon des Soires (67 ha). Secteur 3: Zone de Saint-Véran (110 ha) – Secteur 4: Zone de Daguin (140 ha).

contenter dans le meilleur des cas de produire un nombre de sites au km^2. Encore cette démarche implique-t-elle que les secteurs étudiés aient été prospectés intégralement et de manière systématique, ce qui est rarement le cas. La Figure 7.11 montre, pour quatre zones-tests prospectées systématiquement dans le secteur de Saint-Blaise, l'évolution de la densité de l'habitat par subdivisions chrono-culturelles. Une fois pondérée par la durée de chaque période, la densité moyenne de l'habitat par siècle s'y établit ainsi:

- 0,005 sites/km^2/siècle au Mésolithique
- 0,015 au Néolithique ancien et moyen
- 0,47 au Néolithique final
- 0,03 au Bronze ancien et moyen
- 0 au Bronze final
- 0,93 au Premier Age du Fer
- 0 à la Tène I
- 1,75 à la Tène II/III
- 1,96 au Haut Empire
- 0,65 au Bas Empire
- 1,96 au Haut Moyen Age

Pour l'époque romaine, le dépouillement des résultats des différentes prospections considérées plus haut montre des densités comprises entre 0,1 et 2,5 sites au km^2. Les valeurs les plus élevées sont obtenues dans les Maures méridionales (2,5), dans l'Estérel occidental (1,64) et dans la région de Châteaurenard (1,77). Les plus faibles, dans la vallée de l'Asse (0,09 à 0,16) et dans les Maures septentrionales (0,26). Le massif de la Sainte-Victoire (0,41), le Tricastin (0,44) et le Var occidental (0,47) présentent des densités intermédiaires. Il semble bien que ces valeurs soient déterminées en partie au moins par les conditions naturelles (relief, voies de communication). En Italie, les densités calculées sont du même ordre: basses dans le Massique (0,28), dans la région d'*Heraclea Minoa* (0,31) et en Etrurie (0,33); plus élevées dans l'*ager Cosanus* ou le Molise (0,5); très fortes près des cités, autour de *Capenas* (4) ou de *Veii* (5,4) par exemple (Leveau *et al.*, 1993b: 142–3). Des densités comparables se retrouvent en Espagne et au Portugal: faibles en Andalousie (0,14 à 0,18); moyennes autour de Vila de Frades dans l'Alentejo (0,5); plus fortes en Catalogne, dans la plaine côtière de Penedes et du Maresme (0,6 à 1) (Leveau *et al.*, 1993b: 214). Malgré l'apparente cohérence de ces résultats, on est surpris par l'ampleur des variations d'une région à l'autre. D'une manière générale, les prospections les plus récentes, conduites sur de petits espaces de manière particulièrement intensive, font apparaître des densités très nettement supérieures – de l'ordre de 10 fois – à celles des régions où les recherches ont été plus extensives.

Dans notre secteur d'étude, si l'on accepte la fourchette de 2000 à 3000 personnes vivant dans la campagne au Haut Empire, on obtient une densité de population rurale comprise entre 19 et 28 personnes au km^2. On estime généralement entre 20 et 25 habitants au km^2 la densité de

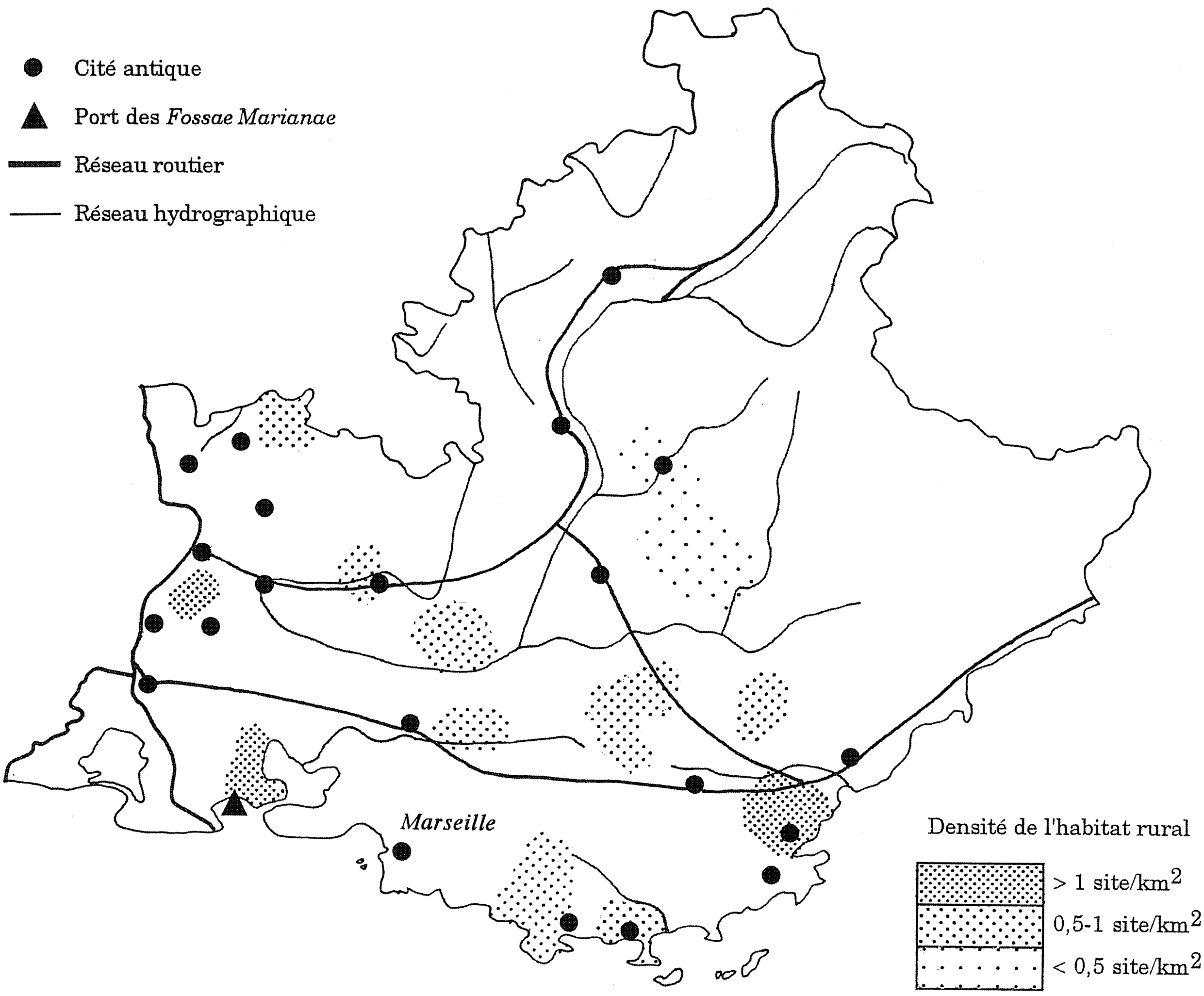

Figure 7.12 Densité comparée des villes et de l'habitat rural en Provence à l'époque romaine.

la population dans l'Empire romain (Nicolet *dir.*, 1979: 85). En Italie, la densité de la population a pu atteindre 40 habitants au km^2, tandis que dans le monde celtique celle-ci n'excédait pas 9 à 10 habitants (Lo Cascio, 1994: 111). Mais il faut tenir compte de la population urbaine. En conséquence, la densité de la population rurale de l'Empire devait être de l'ordre de 15 à 20 habitants au km^2. Les résultats obtenus dans le secteur de Saint-Blaise concordent bien avec l'image d'une densité de l'habitat supérieure à la moyenne régionale.

Niveaux d'urbanisation

L'une des limites majeures de la prospection archéologique appliquée à la recherche paléodémographique réside dans l'insuffisante prise en compte du peuplement urbain. En ce qui concerne la Provence romaine, on se contentera de mettre en parallèle les résultats (très provisoires) qui viennent d'être exposés avec la carte des cités antiques (Figure 7.12). Densité du réseau urbain et densité de l'habitat rural coïncident trop bien à l'échelle régionale pour que l'on ne voit pas là un signe de l'étroite interdépendance de la ville et de la campagne sur le plan démographique. A ce stade de l'investigation, l'archéologie urbaine doit entrer en jeu. Et avec elle tous les types de sources historiques.

CONCLUSION: L'IMPOSSIBLE TABLEAU DEMOGRAPHIQUE ?

L'analyse précédente démontre la possibilité de conduire une étude de démographie générale sur la longue durée à partir de données de prospections, à condition que celles-ci aient été conduites de manière systématique et que les résultats aient fait l'objet de traitements appropriés. Elle a mis en évidence l'intérêt considérable des approches micro-régionales, qui sont à même de fournir des informations non seulement sur des évolutions relatives mais également sur la densité et la répartition du peuplement, c'est-à-dire à la fois sur le long et le moyen terme. En ce sens, il n'apparaît plus impossible aujourd'hui de dresser un tableau démographique,

relativement précis à l'échelle régionale, pour des périodes privilégiées par la documentation archéologique et historique. Ce type de recherche ne peut se concevoir autrement que dans une perspective interdisciplinaire, qui seule permettra de passer du stade de l'approche quantitative à celui de l'approche qualitative. Qu'importe en effet le nombre des hommes, si l'on ignore celui des femmes...

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8. Demography and Romanization in Central Italy

Franco Cambi

INTRODUCTION

The Durham Colloquium greatly impressed me, both for the variety of the methodological approaches and for the richness of the results achieved by the majority of the field survey research projects presented.

John Bintliff stresses the great faith normally placed in site distribution maps which, despite being partial and filtered, are nevertheless 'palimpsests' of a reality which has now disappeared. The particularly intensive methodology adopted by the Boeotia survey permits the identification of a particularly high percentage (about half) of the small settlements of the 4th century (farms) which at one time really existed. In this paper I will demonstrate that in the research conducted in the three territories of Roman Etruria which comprised the Valle dell'Albegna, the percentage of late Republican farms recovered is, even in the most fortunate situations, lower. The lower level of finds is due to various factors:

- the less systematic way in which repeated survey of the sites and of the transects was conducted;
- the markedly high level of re-use and obliteration of the Republican houses by settlements of later periods (the effect of the Roman villas must have been particularly incisive);
- the greater level of urbanisation of this region compared to other Mediterranean regions;
- finally, last but not least, the less intensive fieldwalking methods applied during the survey in the Valle dell'Albegna, compared to the Boeotia survey.

For this reason, considering the nature of the documents with which we are dealing, I maintain that demographic reconstruction based on the number of settlements must be treated with great caution. The contribution of Lo Cascio (1994a, b and in this volume) analyses the data recovered from the literary and legal documents and clearly illustrates the difficulty of a critical assessment of the documentary sources in terms of historical demography, in particular for the Republican period. When from the historical sources we pass to the archaeological sources, we are immediately aware not only of the difficulty, but also of the complexity of the evidence. In brief, while the literary sources can be related to a defined period, of twenty, ten or even five years, and the legal or institutional sources to a specific year, the archaeological document has always only an initial and a final date. A certain type of pot can date a settlement indifferently to 100 or 200 AD, just as the presence of a certain class of finds can date it indifferently to the 4th or the 5th century AD. Therefore it would appear to be fairly difficult to confront a theme such as that of historical demography with data which tend to be spread over such wide chronological spans. This is especially the case when the field survey is not integrated with the excavation of key sites, which permit us to frame in a relatively precise manner the diverse settlement typologies characteristic of the various periods.

Having concluded this somewhat negative and discouraging introduction, I will attempt to illustrate those demographic aspects which can be enriched in a substantial manner by the study of surface survey finds, so as to present a more optimistic view of the problem. I am in fact increasingly convinced that from our site distribution maps we can recover important indications, albeit generic, as to general demographic trends, even if we cannot recover the approximate numbers which we desire so much. Paradoxically, the attractive models which we have admired in the papers of E. Zubrow and T. Wilkinson (Mediterranean archaeology maintains a suspicious and unjustified diffidence towards such models), have provided valuable data for the study of pre-State Mediterranean society or that of the ancient Orient, and have been less successful for research into the landscapes of post-prehistoric periods. When the landscapes are complex, multistratified and encumbered with a notable quantity of institutional connotations and implications (listed below), then the parameters and the variables which must be applied for the formulation of these models are so wide and so many as to make this method impractical.

Nevertheless it is possible, and this is in fact the greatest contribution of landscape archaeology, to achieve

a qualitative characterization of forms of habitation and of their distribution throughout the territories and regions under study. In other words, to construct a reliable demographic and typological scheme, in which the people who made their particular imprint on a region can find a place, in the sense of the activities they carried out according to the following criteria:

- social (who were they ?)
- institutional (what were their roles and their ranks in society ?)
- economic/ecological (what were their activities and what was their effect on the environment ?)
- religious and cultural (to what degree did their cults and other factors condition the distribution of the settlements in space ?)

Having said this, I wish to illustrate my method of viewing demographic analyses through an example.

A SOUTH-CENTRAL ETRURIAN LANDSCAPE AND ITS ROMANIZATION

The third century BC

Most Romanists are familiar with the scarcity of archaeological finds relating to the first period of romanization (IV-III century), and this is accentuated when contrasted with the considerable amount of material known from the second period of romanization (II century) and the period of the villas. The relative lack of data for the III century and the great uncertainty regarding the date of many sites significantly limit our ability to analyze the character of the agrarian landscape of the earliest romanization.

In this paper, I will discuss the data furnished by the project 'Fra la valle dell'Albegna e il Fiora', a systematic survey in southern central Etruria. I will use the figures in the following tables, as a base from which to calculate statistics concerning patterns of settlement and land use in the various areas studied by the project for the III century B.C. (Figures 8.1 and 8.2):

	certain	uncertain	total
house 1	29	45	74
house 2	15	6	21
house/tomb	7	19	26
village 1	2	–	2
village 2	2	–	2

On the basis of these figures, we can calculate a potential distribution (expressed in percentages) of 'families' or, more appropriately households in the region just after the conquest. The minimum number in the table is based on the securely dated ('certain') sites, while the maximum number reflects the sum of the 'certain' together with those sites most probably datable to the period in question. We can assume that each category of site corresponds to a different number of households. Following roughly the same guidelines normally utilised in historical-demographic studies of precapitalist cultures, we can construct a quantitative scale: each house 1 represents one household, each house 2 – two households, each house/tomb – one half of a family or household, each village 1 – five or six households, and each village 2 corresponds to ten to twelve households (Figure 8.3).

The projections result as follows:

	certain	uncertain	total
house 1	29 (=29)	45 (=45)	74 (=74)
house 2	15 (=30)	6 (=12)	21 (=42)
house/tomb	7 (=3.5)	19 (=9.5)	26 (=13)
village 1	2 (=10/12)	–	2 (=10/12)
village 2	2 (=20/24)	–	2 (=20/24)

These figures must be subsequently subdivided according to their dispersal throughout the three different political territories into which the valley was divided immediately following its political romanization: the *ager Cosanus*, the area of Talamone (which remained to a great extent culturally Etruscan), and the territory of the prefecture of Saturnia. Table 8.1 represents the subdivision of our figures. These figures, in turn, generate Table 8.2, which represents the regional distribution of households in percentage form (Figure 8.4).

ager Cosanus	**certain**	**uncertain**	**total**
house 1	11 (=11)	26 (=26)	37 (=37)
house 2	4 (=8)	1 (=2)	5 (=10)
house/tomb	3 (=1.5)	12 (=6)	15 (=7.5)
village 1	1 (=5/6)	-	1 (=5/6)
village 2	1 (=10/12)	-	1 (10/12)
Talamone	**certain**	**uncertain**	**total**
house 1	6 (=6)	17 (=17)	23 (=23)
house 2	3 (=6)	5 (=10)	8 (=16)
house/tomb	2 (=1)	7 (=3.5)	9 (=4.5)
Saturnia	**certain**	**uncertain**	**total**
house 1	12 (=12)	2 (=2)	14 (=14)
house 2	8 (=16)	-	8 (=16)
house/tomb	2 (=1)	-	2 (=1)
village 1	1 (=5/6)	-	1 (=5/6)
village 2	1 (=10/12)	-	1 (=10/12)

Table 8.1. Subdivision of figures.

	minimum	**maximum**	**mean**
ager Cosanus	38 = 39%	72 = 43%	55 = 42%
Talamone	13 = 13%	43 = 27%	28 = 22%
Saturnia	46 = 48%	49 = 30%	47 = 36%
Total	97	164	130

Table 8.2. The regional distribution of households in percentage form.

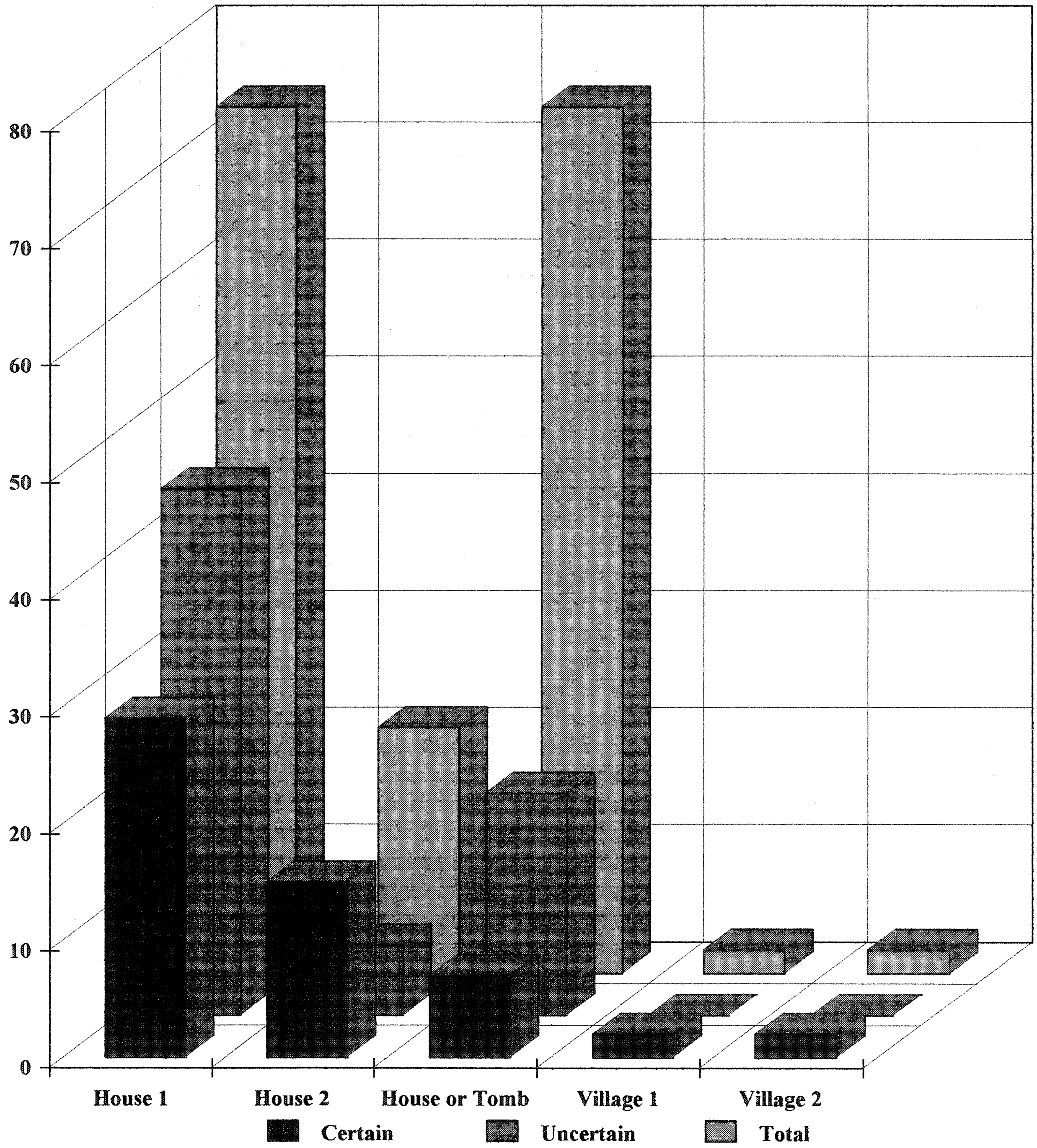

Figure 8.1. Albegna Valley in the 3rd century B.C. Number and type of the sites discovered in the survey.

Beyond the absolute figures, the mean percentages demonstrate that the *ager* Cosanus was the more populated territory, with a considerable level of human activity from the III century (together with those people resident in the countryside, we must consider the urban colonists). The Republican landscapes of central Italy were so thoroughly altered by those which succeeded them that only a minority of III-II century sites are visible to a survey project: the percentage of sites identified, on the basis of a rational comparison between documentary and material evidence, varies between twenty and thirty-three percent.

The most densely populated sector was, logically, the area closest to the Latin colony. The conquest, the colonization and the construction of the Via Aurelia Vetus (242–1 B.C.) accomplished their common goal of incorporating into the Roman sphere this territory and exploiting its diverse resources in an integral manner. The limestone hills surrounding Cosa offer much less arable surface relative to the area of Vulci. However, the greater

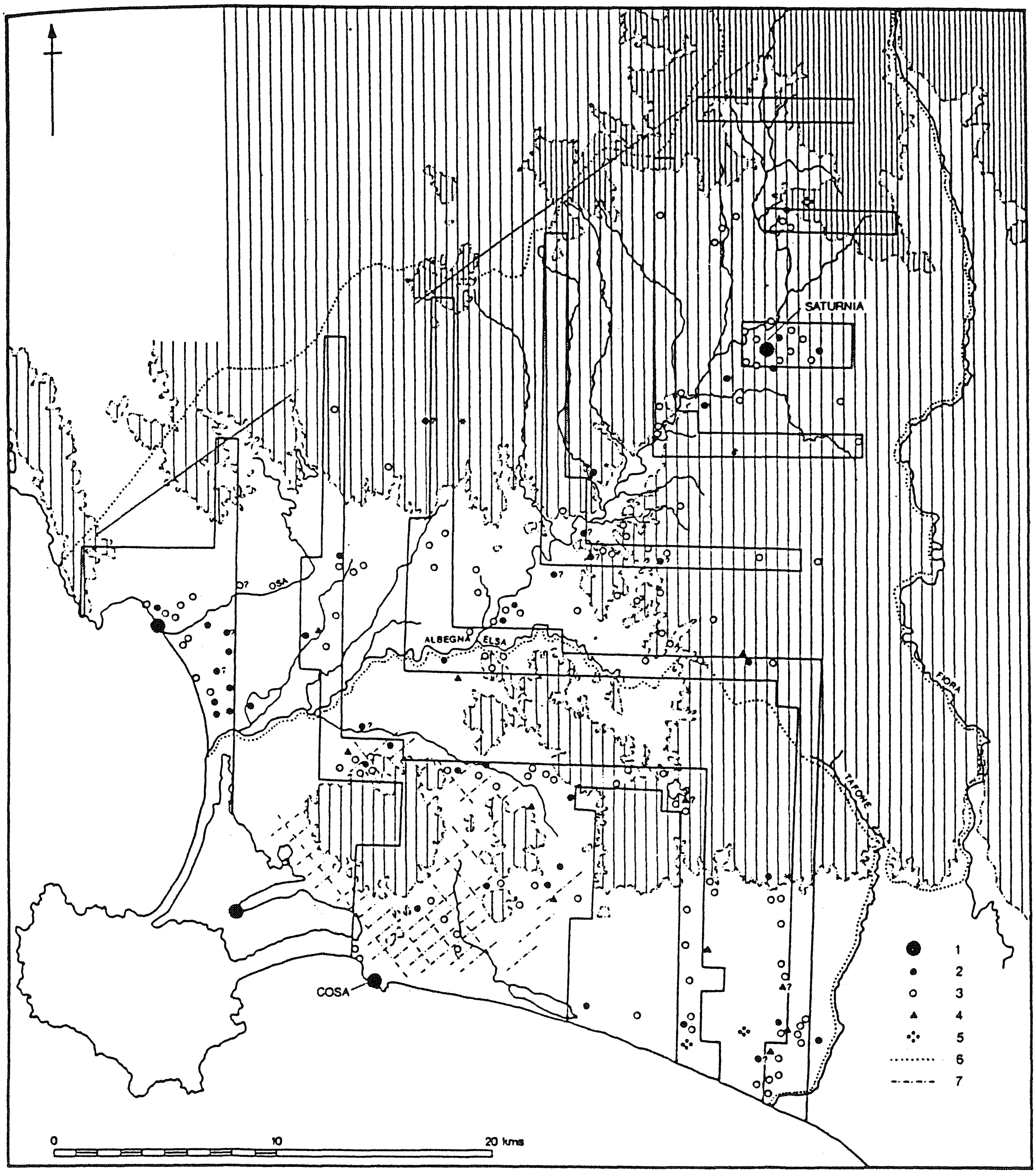

Figure 8.2. The settlement pattern in the 3rd century B.C. 1. Town or major centre; 2 Domestic site; 3. Domestic site of uncertain date; 4. Tomb; 5. Village; 6. Territorial boundary; 7. Centuriation.

variety of soils and geomorphological features offered the colonists ample pastureland and woodlands within a five kilometer radius from Cosa, its safe walls and its market. The previously favoured routes between Vulci and her ports and between Vulci and the Albegna and Fiora valleys were rendered minor by a colonization which, within a limited space, offered an integrated and efficient system of administrative functions, military control and economic activities (diverse agricultural production in the countryside just outside the city and commercial exchange at the ports). Vulci was thus transformed from central place into peripheral settlement. Once the colonists and their families were established at Cosa and in the immediate surroundings, Roman control of the region was secured and the areas further from the centre could be left to their former owners. The occupation of more extensive arable surfaces, with lighter soils more adapted to the cultivation of cereals, such as in areas along the coast, would have probably rendered greater agricultural productivity but would also have necessitated more dispersed settlement, and effected problems of safety, distance from markets, lack of co-operation between colonists, and complications due to their

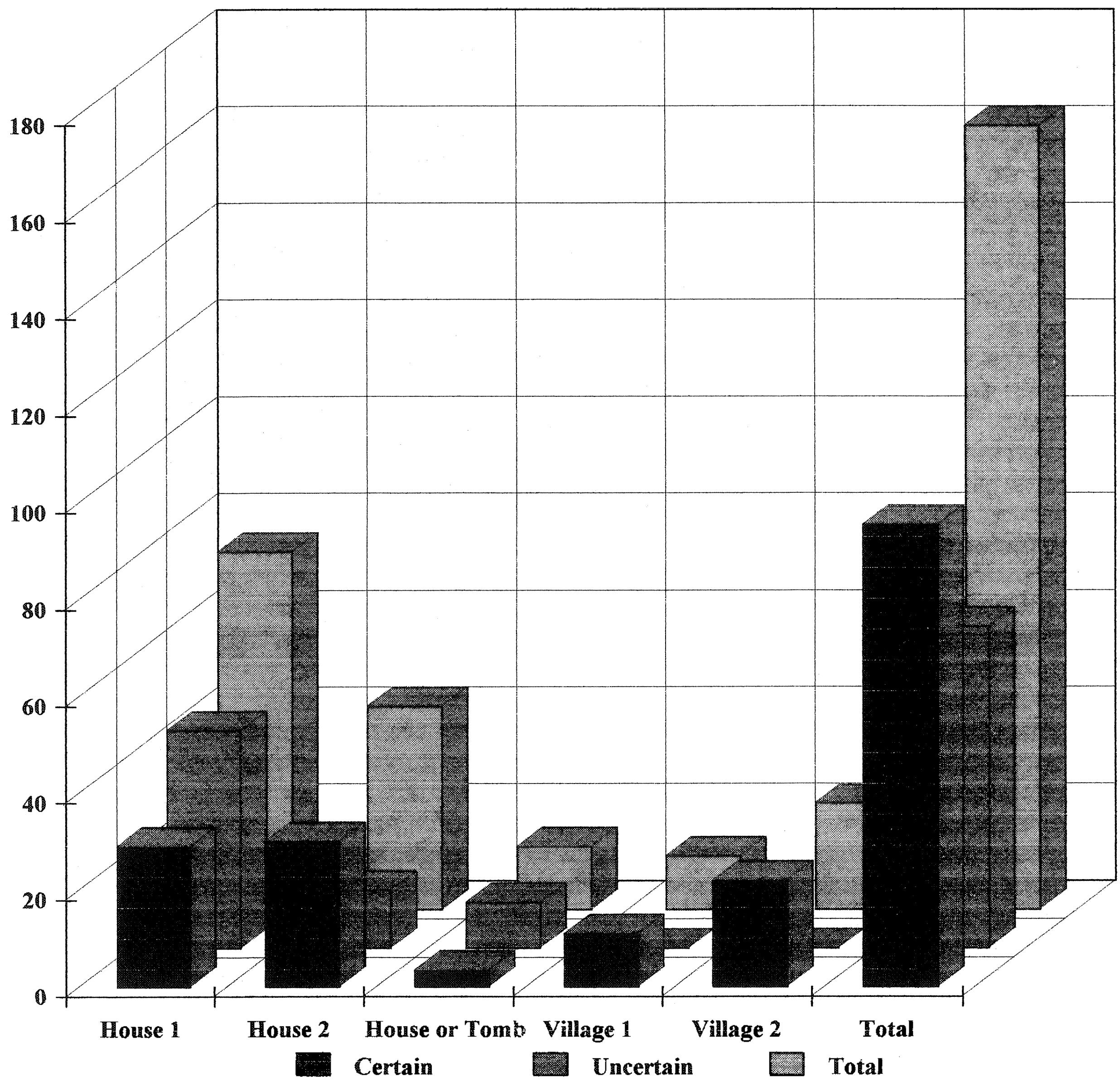

Figure 8.3. Basic number of the familial groups in the countryside in the 3rd century B.C.

isolation in a still hostile environment. The group psychology of the Cosan colonists is reflected, in part, by the distribution of their houses. Colonists living in the city were tied to a certain tradition by cults and festivals, whilst colonists resident in the countryside felt integrated into the community only if contacts with the colony were stable and frequent (Torelli, 1988). In a similar case, around the same time, the colonists sent to Alsium settled in the immediate area of the colony, even building their houses on top of the nearby ancient necropolis of Caere, rather than inhabiting the fertile coastal plain (Enei, in press).

Turning to the case of the territories of the future colony of Heba and Talamone, the relative percentage of population distribution requires explanation. In this zone, only the land surrounding Talamone appears to have been densely settled, despite the considerable number of sites of uncertain date. The most obvious deduction is that, given the expansive space available, old and new landowners remained or established themselves, as much as possible, in the flatter, more fertile and more cultivable coastal areas. Settlements above one hundred meters altitude are rarely found in this region. One should not undervalue, though, the continuity of settlement at Talamone, with its important sanctuary and its port, active in the III century B.C. as demonstrated by the rather early graeco-italic amphorae found in the area.

Our percentages for Saturnia, while informative, must be interpreted with attention to the types of sites and their distribution. It is not certain that Saturnia was a prefecture before becoming a colony in 181 B.C. (Festo, s.v. *praefec-*

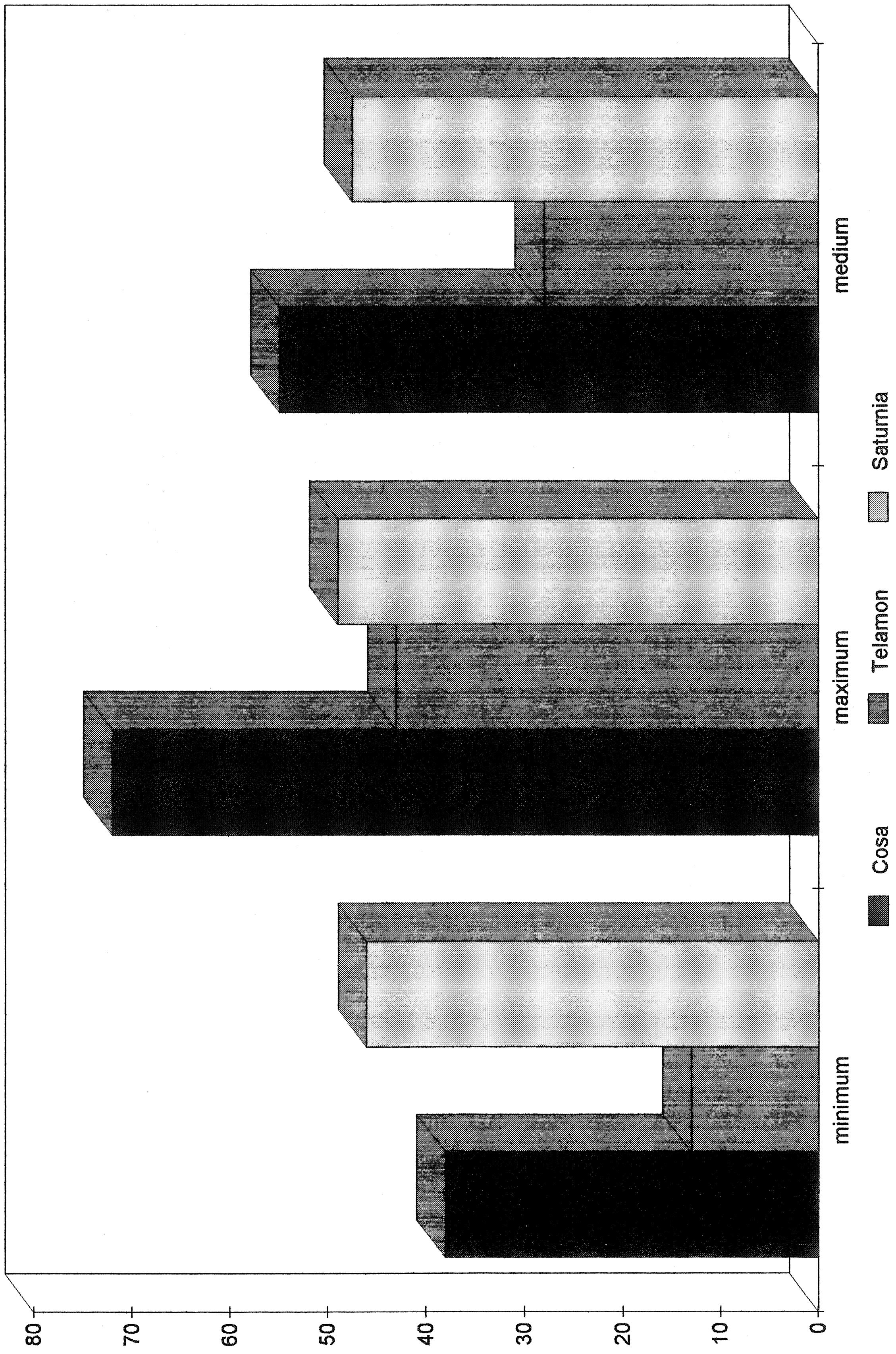

Figure 8.4. The distribution of the sites in the ager *Cosanus and other territories in the 3rd century B.C.*

tura; Salmon, 1969: 119; Harris, 1971: 150). The first phase of romanization did not cause significant changes during the III century. A few small houses were built in the area of the future colony, dispersed casually due to the ample availability of land. A few kilometers to the north, the cohesion and continuity of the Etruscan settlements associated with the old *pagus* of Semproniano present a much stronger cultural element.

Beyond its effects upon the social structure related to the agriculture of Vulci, romanization presented profound consequences for the environment in the region in question. In 280 B.C., the plains and hills between the Albegna and Fiora valleys were only partially deforested; the absence of sites in certain zones with good surface visibility, in proximity to areas highly populated in antiquity, suggests that extensive tracts of primary forests remained. These appear to be once-wooded zones deforested in recent times. Together with the ancient woods surviving today, one must consider the phenomenon of reforestation; the demographic decline caused by the conquest, and the accompanying movement of populations, liberated much cultivable area for the arriving colonists, but also permitted uncontrolled expansion of woods in marginal zones not yet allotted to Romans. Woodlands also covered large portions of the coastal plains; in the area of Pescia Romana, the coast seems to have been an area of alternating lagoons and forests. The situation changed significantly towards the interior. For the most part, the valley bottom of the Albegna was populated, while the hills above were forested. Small concentrations of habitations, occasionally of considerable dimensions, flanked the left bank of the lower Albegna, while the right bank was generally less populated as a result of its naturally more inhospitable character and its relatively low agricultural potential. At a certain point, however, along both banks of the river, the vegetation became thicker and gradually took on the character of a wood. The total void of sites which characterizes the mid-valley of the Albegna clearly indicates a sort of natural barrier at this point between the lower and upper zones of the valley. Perhaps an Archaic road still ran between Marsiliana and Saturnia, traversing this forested area. More likely, though, the future *ager* of Saturnia was completely cut off from the coast.

The second century BC

Archaeology does not measure the state of the exhausted fields of the *ager* of Vulci at the end of the Second Punic War; the map of 200–150 B.C. (Fig. 8.5) illustrates primarily the final decades of this period. The population of Cosa was reinforced with one thousand new colonists in 197 B.C. (Harris, 1971: 158; Toynbee, 1981, II: 159). Brunt (1970: 84, n.4) hypothesizes a twenty percent decline in the population with *latino iure* (latin rights) during the course of the war. The comprehensive demographic decline must thus have been considerable: in the case of Roman citizens perhaps as much as fifty percent (Toynbee, 1981, I: 595).

At this point, the wealth of evidence provided by our survey (compare Figs. 8.5, 8.6 and 8.7) offers further examination of demography. The first problem regards the difficulty in the identification of minor sites by surface survey. A fine example of this is presented by the figures for the site types house 1 and house 2, certain and uncertain, of the II century B.C.:

	house 1	house 2
ager Cosanus	34+37	13+3
ager Hebanus	43+30	22+8
ager Saturninus	25+41	23+2
total	102+108	58+13

Retaining the criterion which assumes that each house 1 is inhabited by one family and thus counts as one household, while each house 2 is inhabited by two families, the figures above may be multiplied by five (since twenty percent of the survey universe was covered), thus obtaining a minimum of 800 households and a maximum of 1405. Judging by the great discrepancy between these two figures, it is obvious that neither of these can be considered representative of the region's population. Even though we can never know precisely the number of the colonists' houses, large and small, dispersed throughout the landscape between the Albegna and the Fiora valleys, it is probably appropriate to assume that of the five to six thousand colonists (heads of family) established in the region between 197 and 181 B.C., according to our literary evidence, at least four thousand settled in extra-urban contexts. Approximately one thousand colonists could have inhabited the three colonies: 300–350 at Cosa; and 250–300 at Saturnia (Duncan Jones, 1974) and Heba, respectively. The colonists living in the countryside thus numbered approximately five thousand, including both those who arrived in 197 and 181 and those who were there prior.

Only between 800 and 1405 of the houses or households of the presumed five thousand are today visible to a surface survey (Figure 8.7). If the calculations so far effected are even roughly accurate, a group of researchers normally sees, in such a survey, twenty to thirty-three percent of the small rural settlements which actually existed. This low figure may be explained by various factors. Some houses of the III and II century may have been obliterated by successive landscapes, particularly by large villas. In scatters relating to certain villas founded in the I century, fragments of black glazed ceramics dating to the III-II century have been found. This phenomenon may be visible (or present yet invisible) in other villas, as well. The second factor is that of alluvial (in the lower Albegna) and colluvial (mid-valley in the Albegna) disturbance or burying of sites. The problem of low surface visibility in areas today not arable is also significant. In areas deforested and subsequently cultivated (only since the late 1970s), Republican houses are relatively clearly visible in scatters of cultural material. In zones still covered by wild vegetation, however, survey is obviously complicated and its results do not reflect the considerable number

Figure 8.5. The settlement pattern in the early 2rd century B.C. 1. Town or major centre; 2 Villa; 3. Domestic site; 4. Domestic site of uncertain date; 5. Tomb; 6. Village; 7. Kiln; 8. Territorial boundary; 9. Centuriation.

of colonists' houses which not unlikely may have existed there. In the territory of Orbetello, in an area of relatively dense growth, analysis of aerial photographs has identified two houses contiguous and aligned within a centuriation entirely invisible to a survey on the ground. In several sectors of the region, Orbetello and Giannella among them, ancient sites have been obliterated by modern urbanization. The evaluation of these selective factors leads to the conclusion that, in the most favourable cases, a survey such as ours may find thirty to thirty-three percent of the rural colonial houses extant in the II century B.C.

Along with the visibility of sites, the different types of sites must be considered when examining landscape history and demography. In the *ager* of Cosa, increased population pressure in the II century B.C. resulted in the building of smaller houses in the more desirable areas, especially those closest to the the city. Further away from Cosa to the east, larger and more complex houses were built, some of them in the form of rural agglomerations. Villages, whether simply small groupings of houses or settlements with an

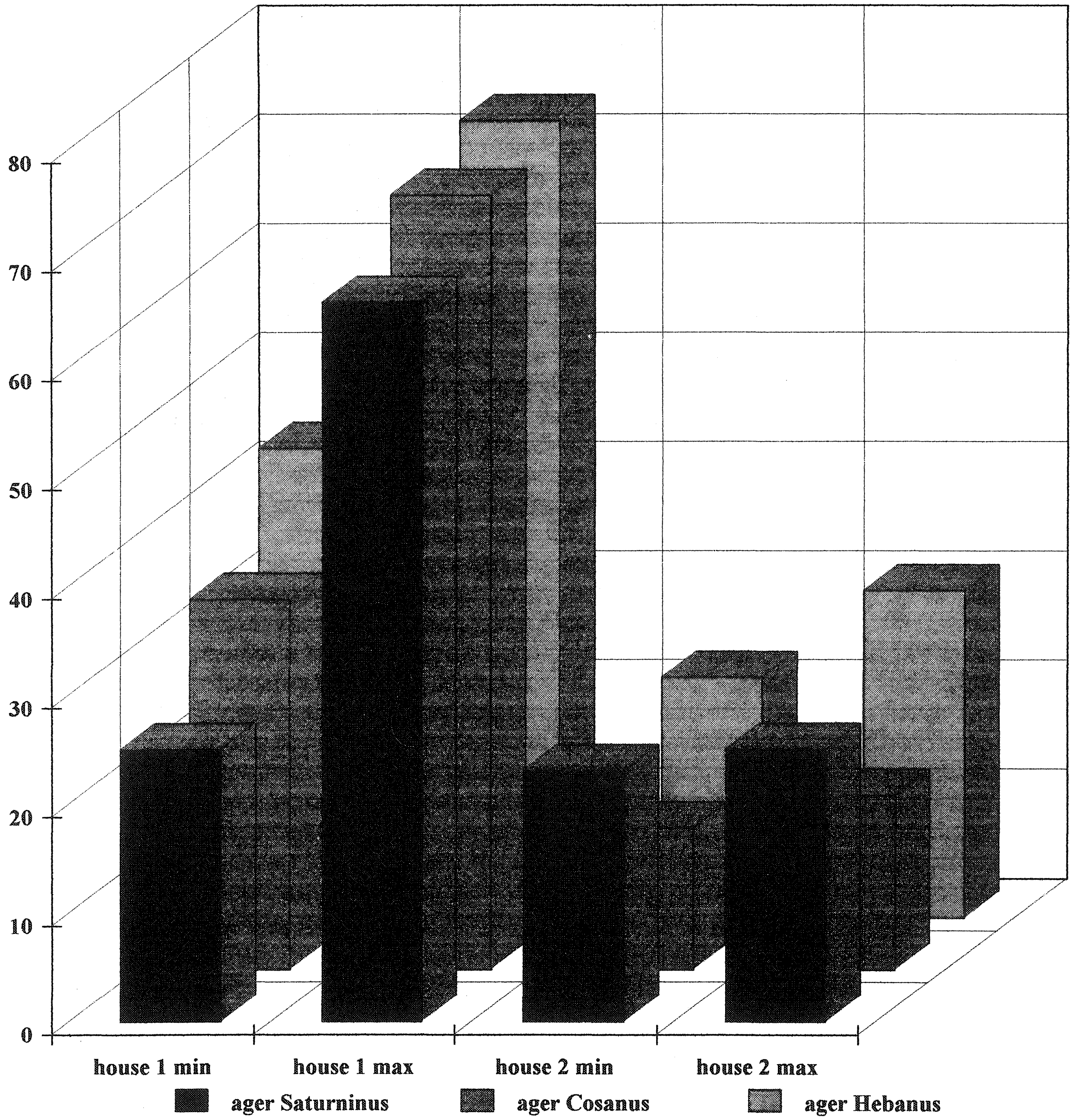

Figure 8.6. The basic population of the farmsteads in the three Roman territories in the 2nd century B.C.

administration of their own, such as the *pagi* and *vici*, are not at present archaeologically describable in their particulars, principally due to lack of excavation. They are most visible and notable from the late II century B.C., a period which saw an intensification of trade. In any case, in the zones furthest from the city the colonists tended generally not to isolate themselves from one another but rather to group their houses together into agglomerates or villages. The colonists resident in the coastal plains must have been significantly affected by the opening of the Via Aurelia Nova (end of the II century B.C.). To the north of the mouth of the Albegna, the area of Talamone remained attractive. The birth of the settlement of Heba represents a notable change in the lower valley of the Albegna. This event is reflected in the subsequent occupation of the surrounding territory, so dense as to cover practically all available land surface below 300 meters altitude. The effect upon the Albegna valley is clearly visible along the bank previously sparsely populated. Such changes were likewise impressive in the upper valley of the Albegna

following the construction of the Via Clodia in 183, and especially following the establishment of Saturnia as a prefecture in 181 B.C. The Etruscan landowners of the villages and houses of Semproniano, after surviving the conquest, also succeeded in avoiding an expropriation of their property in connection with this event. Evidently, their lands did not interest the colonists. The agrarian landscape of the new colony was concentrated as much as possible to the northeast of the city, in an area favoured by the excellent quality of its soils and by its proximity to both the Via Clodia and the centre. The expansion associated with the growing human activity in this area rather ignored the valley of the Albegna, except for certain more attractive tracts along both banks, concentrating principally in areas perhaps not ideal pedologically but with gentler relief and easily travelled valleys to the south. The *ager* of Saturnia was dotted with sites of different types, demonstrating trends similar to the patterns already seen in the territory of Cosa; dispersed yet dense settlement in the zones nearest to the city, with a distribution of concentrated nuclei in the areas further away. One of these nuclei grew up at a place called Poggio Fuoco, practically at the border with the *ager* of Cosa, along the road between Saturnia and Vulci.

The landscape and the environment

One can only imagine the effects upon the environment caused by the demographic growth following the Second Punic War, measuring approximately thirty percent between 200 and 160 B.C. An impressive example is presented by the figures for Roman citizens alone: the *civium capita*, 270,212 in 234, fell to 137,108 in 209 (-49,3%), reached 214,000 by 204 (+36%), and climbed to 337,000 (+37%) in the 160s (following the old assessment of Toynbee, 1981, I: 601; but see now the new data offered by Lo Cascio [1994a, b and in this volume]).

The woodlands of central Italy, having grown during much of the previous century, were controlled (not permitted to expand) in the years immediately following the war, but very soon the trend of the II century was reversed: entire forests disappeared in a continuous deforestation, although controlled, which lasted until another reversal of the trend (from deforestation to regrowth) in the III century A.D. A fine example is provided by the research of P. Hemphill (1988): in the area to the south of Blera, human-generated stress upon the environment was intensified between the II century B.C. and the I century A.D. The woods of the area were reduced to very little by the II century A.D., and regrowth was permitted only in the successive centuries. Despite the cuttings of the past two hundred years, the current extent of forested lands in southern Etruria is surely greater than that of the early Empire. Literary evidence supports this condition: Livy and Floro, recounting the events of 310 B.C., describe the Silva Cimina as 'terrifying' – the area of Sutri was thus still sparsely populated at the end of the IV century (Liv. IX, 36; Floro I, 12; a reference to primary forests is clearly discernible in these passages: cf. Pratesi 1985: 62). The *senatusconsultus* of 210, at which the decision was made to deport the Capuans to the *agri* of Veio, Sutri and Nepi confirms this impression, demonstrating the considerable availability of lands to settle in territories conquered by Rome already in 383 B.C.

By the mid-II century, woodlands were no longer viewed in an exclusively expansionistic manner: using the concept of *silva caedua*, Cato (10.11) stressed the need for a rational use of such resources. The hills of the Albegna and Fiora valleys were nonetheless subjected to major alterations, still visible today on many slopes covered by low vegetation. The woods increase in the interior, not because the region is impervious and less attractive, but because of ancient customs preserved for centuries. Despite the intense deforestation from the II century B.C. through the II century A.D., the relief of the hills remained mostly intact. The survival of traces of primeval forest on the slopes of the major mountains of southern Etruria is due to their sacred character; the Amiata, Sabatini, Cimino and Soratte mountains, all sites of residual volcanism such as thermal waters, were actual sanctuaries throughout much of antiquity, considered the realm of underground gods. Romanization pervaded the valleys and hills, replacing centuries-old administrative structures yet respecting ancient cults, changing the names of the gods, of course. The terror of the Silva Ciminia, so emphasized by Livy, was thus inspired by both the natural features of the place and the profanity of such an incident in the great forest inhabited by a god. Epigraphic sources indicate that the slopes of the *mons* Ciminius were frequented by devotees of the Bona Dea until the Imperial period, despite the cultivation of extensive areas there following the opening of the Via Cassia (Gasperini, 1989).

THE COLONUS AND THE HOUSE

The problem of rural architectural typology in our survey universe remains open. This is most serious for the III century: without a sufficient number of excavations, it is impossible to reconstruct the houses of the first colonists and the organization of their parcels of land. In the immediate periphery of Rome, a certain consistence of typology for rural constructions was already current in the III century One example of this typology is the building of Torre Angela along the Via Gabina, in the eastern *suburbio*, founded in the first half of the III century and added on to twice in the course of the same century (Carandini, 1989: 161). Other examples are the contemporary farms built upon a polygonal lower storey in the territories of Anagnia, Cora and Tibur (Andreussi, 1981). A passage of Valerius Maximus (4.4.6) mentions the agellus (with many *vilici*) of A. Regolus, along the Via Gabina. The constructional features of these sites (important for the development of the villa) demonstrate

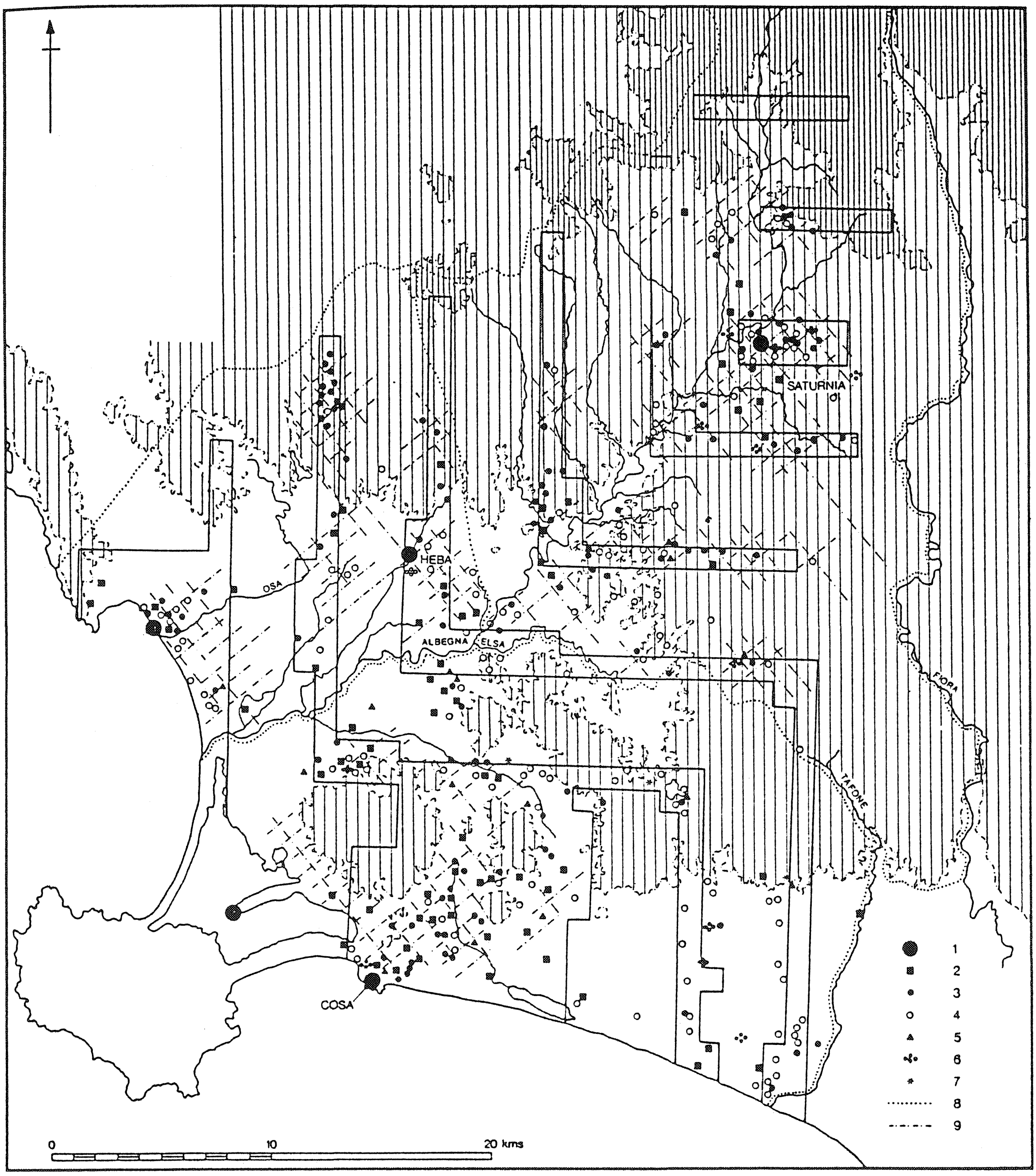

Figure 8.7. The settlement pattern in the late 2rd century B.C. 1. Town or major centre; 2 Villa; 3.Domestic site; 4. Domestic site of uncertain date; 5. Tomb; 6. Village; 7. Kiln 8. Territorial boundary; 9. Centuriation.

that rural architecture elaborated complex typologies, affected in part by techniques learned from peoples conquered by Rome (Carandini, 1989). Along with this trend of borrowing, however, ran a current of research and experimentation in functionality and the division and specialization of domestic and farm space. This is equally true of the Roman and Etruscan worlds, respectively; one need look no further than the complex plan of the late Archaic site of Tartuchino in the area of Saturnia (Perkins-Attolini 1992).

Rather expansive houses or farms of the II century are also known from Roman Etruria, which demonstrate a certain study of articulation and function of spatial units within the buildings. The first example, from our survey universe, is the colonist's house of Giardino Vecchio (Cosa), constructed shortly after 200 B.C., probably in connection with the arrival of new colonists in 197. Its surface area of five hundred square meters is impressive for a farmhouse, and its owner built it with a fine understanding of how to organize his space functionally, dividing the residential

quarters from the stalls and the rooms associated with the production of wine. The house's structures are functionally essential, yet a certain knowledge of the need for specialization in the organization of space is evident on the part of the colonist. The excavation of Giardino Vecchio elucidates the general characteristics of the site type 'house 2', the residence of a colonist become wealthy or at least able to build himself a large house. At least six other examples of complex II century houses in southern Etruria with a precise architectonic physiognomy have been found in the southwestern sector of Blera. The large house in the area of Villa Sambuco is among these (Ostenberg, 1962: 313ff; Berggren, 1969; Carandini, 1989). Its surface area, considering its two storeys, is not significantly different from that of the Giardino Vecchio farm, but certain further developments in the ordering of building space render it notable. The house appears organized along generic axes differentiating spheres of activity: storage rooms in the northern half of the lower storey, the stall in a southwestern wing, and residential quarters contiguous to the entrance way and in the upper storey (Carandini, 1989; Wallace Hadrill, 1988: 50). The site's excavators date it to the end of the II century, amidst much debate, but they admit to having also found black gloss ceramics and other material datable to 200–150 B.C. A very poorly preserved building found in the surroundings of Vicus Matrini can probably also be classified among the houses with two storeys (Andreussi, 1977: 32, n.44). A measure of differentiation between a large farmhouse and a small villa, even if the two are contemporaneous, is offered by the II century site of Selvasecca, in the same area (Berggren, 1969). Its surface area is more than double that of the Giardino Vecchio and Sambuco houses (although II century villas of 500 meters squared are known). However, the principal difference between the two classes of building lies in accentuation of their axes differentiating space; at Selvasecca, building materials were manufactured in the building's northeast wing, whilst residential quarters were found in the opposite (southwest) corner (Carandini, 1989).

From the examples presented here, a significant difference emerges between the type of colonist's house developed in central Italy (Giardino Vecchio and Sambuco) and buildings not necessarily larger but necessarily of greater architectural wealth such as Selvasecca. The key to this distinction lies in the progressive specialization in the ordering of internal space. It is clear that both the recently arrived colonists and the more eminent figures in the territory, regardless of their origins, built their houses with precisely articulated models in mind, which they adapted to the demands of the moment. Large houses belonging to peasants were present during the II century in the region between the Albegna and Fiora valleys. Our survey did not find scatters equally or slightly more extensive than those interpreted as 'house 2' with some element which could qualify them as villas, even though in many cases the identification of rhomboidally shaped bricks seems to imply relatively refined constructions. This condition may certainly be affected by destruction and differential preservation of materials, considering the fragility of mosaics and stucco relative to walls. However, this trend has been measured within a sample of 60/70 "houses 2", some of which had been ploughed shortly prior for the first time. It thus appears more reasonable to conclude that in our survey universe a notable experimentation in rural architecture was undertaken by colonists who had recently gained wealth (possibly from their first grape harvests, attested to indirectly by the rudimentary press found at Giardino Vecchio) and who desired more comfortable and efficient houses. How much of this experimentation was conditioned by encounters with the agricultural landscapes of more developed spheres recently conquered, experiences precociously put to use in the surroundings of Rome (Carandini, 1989), is not possible to judge with certainty. The situation, analyzed according to region and chronology, was obviously in reality quite diverse. The notion that colonists lived in small houses, with just enough space for their families and few animals, should be put to rest once and for all. This image was basically propagandistic and ideological, cultivated in association with the later colonizations with which leaders from the time of Caesar through the Augustan period attempted to place military veterans; archaeological evidence for this may be seen in the six small houses at Monte Forco in the *ager* Capenas, built in Augustan times and made up of just one room each (Potter, 1985: 137–138). No comparison at all is possible between these practical shacks of Caesarian and triumviral times and the large house of Giardino Vecchio. The former may be our most appropriate evidence for the examination of the demagogic intentions behind the programmes of colonization by veterans. We do not know for how long these small buildings maintained their original function, but it is likely that they shortly became minor outbuildings related to the villas which subsequently gained prominence in the Roman countryside.

Translated by Helen Patterson & Dominic Vitiello

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9. Beyond Historical Demography: The Contribution of Archaeological Survey

Simon Stoddart

INTRODUCTION

The assessment of population trends remains one of the pressing issues of the modern world. To what extent can these trends be traced back in time beyond the censuses of the historical geographer and the written record into periods that only archaeological evidence can cover ? The only census of the prehistoric record is provided by material culture (more specifically skeletons, structures, sites and ceramics [Chapman, this volume]) and this requires specialist treatment and analysis to avoid misconceptions. The assessment of the specialist methods by which the evidence of material culture is transformed into demography cannot be properly considered in isolation from the other symposia of the POPULUS project, but the issues considered here will be related principally to the papers presented in the Demography Symposium at Durham.

The papers given in Durham on 25 November 1996 were given very good guidelines to follow (Sbonias, this volume) and this commentary has followed the simple strategy of selectively following these same guidelines. The strictures of Sbonias (this volume) are clear and well conceived: any explicit attempt to reconstruct demography from archaeological evidence should proceed systematically from source criticism (principally of survey method), through equations for population estimates, to the presentation and explanation of patterns of demography. Archaeologists should be very conscious of the problems involved in this systematic procedure, and the indirect source of their information on demography (Chapman, this volume). Nevertheless, although the problems are often emphasised, their identification is a means towards establishing greater precision of population estimates, and outside observers should be optimistic that broad comparative population trends can be reconstructed from archaeological evidence, without written documentary aids.

SURVEY METHOD

The central focus of the POPULUS project has been to extract a means of establishing common criteria for analysing survey data. Population estimates (see below) derive from two principal sources: land use intensity and site size/number. Both require a merging of the quantitative and qualitative. Even in the Mediterranean, which has been considered by many anthropologists as the coincidence of a natural and cultural region (Davis, 1977), there are major differences between the north and south rim which affect definitions. Many examples could illustrate this, but two relevant to the present discussion will be given here. In the prehistoric period, ceramic recognition is often highly varied across the Mediterranean and alarmingly weak for the very phases of demographic transition we are trying to detect (Malone and Stoddart, in press). In the Roman period, roofing and other constructional materials in Sicily and Southern Italy were very different from those in Malta and North Africa to the south. A qualitative difference in site definition is required that makes cross-comparison problematic, but not impossible.

Differences in methodology also weigh heavily (Mattingly, in press). The high quantities of material recovered from the Eastern Mediterranean have led to recovery strategies based on the counting of sherds. The lower quantities of material recovered in the central and western Mediterranean have permitted a greater emphasis on the weighing as well as counting of material. This latter combined strategy should allow an assessment of sherd number alongside sherd size, and provides a means for checking that sherd number is not a product of a distorting, perhaps geomorphological, process. Studies need to be undertaken to assess whether sherd numbers are a sufficient measure of density of material recovered by archaeological survey. The next few years should see the publication of a number of such analyses. Many scholars have pointed to the increasing site densities retrieved by more recent surveys (e.g. Cherry, 1983). The implication has been that most of the variation is the result of increasing sophistication and intensity of survey. However, as more examples of intensive survey become available for comparison, it is clear that much of the variation is a product of

real inter-regional differentiation It is too easy to exclude surveys defined as less intensive by self-proclaimed Mediterranean survey watchdogs, and miss the opportunity for effective inter-regional comparison. Structured principles of comparison for different types of survey need to be developed, which allow comparison of the full range of surface evidence from the antiquarian to the highly intensive (e.g. Novacović, this volume).

The major distinction between modern and ancient demography is the nature of the sample. In the modern census, the sample, although not as complete as modern states would like to maintain, can be readily assessed. In the archaeological census, the first pressing need is to assess the fragment of the original archaeological record that is preserved – to correct for the missing sites (Sbonias, this volume). Some factors causing missing sites are geomorphological (e.g. alluviation and erosion). In some cases, burial may have an important cultural causation such as that provided by tell development (Wilkinson, this volume). Other causes of site loss are related to the preservation of the material culture (prehistoric as against historical pottery) (e.g. Malone and Stoddart, in press). Still further causes are related to the supply of chronologically sensitive material (most notably Millett, 1991). New technologies such as Geographical Information Systems may be able to present these biases systematically but not eliminate them. A thorough filtering of the data should precede any demographic comparisons.

Control of the sensitivity of chronology is central to the (in)accuracy of demographic interpretations by archaeologists. The radiocarbon revolutions of the 1960s and 1970s and the dendrochronological advances of the present decade are providing a more precise basic framework, but this rarely affects the chronologies of rural sites. A false impression of contemporaneity is bound to affect the accuracy of the distribution of archaeological sites. Furthermore, archaeological periods are bound to be of unequal length and distributed across the Mediterranean in an unsystematic manner, in such a way as to affect inter-regional comparison. The only solution is to register explicitly the differences in chronological precision of different regions before proceeding to interpretation. One local solution of "weighting" is provided by Trément (this volume) for the south of France.

POPULATION ESTIMATES

Two approaches to population estimation have become current in the archaeological literature. Firstly, there is the apparently direct approach of working from site numbers and site size to estimates of population. Perkins (in press) has systematically applied this approach to the pre-Roman data appearing from the Albegna valley and Ager Cosanus surveys. Secondly, there is the indirect interpretation of the intensity of land use within a given territory. Some promise lies in employing both approaches and assessing how they match each other (Wilkinson, this volume). Trément (this volume) has also adopted a similar comparative technique. However, whatever the aspirations of these techniques, they amount to equations calculated from proxy data, especially ceramics (Chapman, this volume). Nevertheless, proxy data can provide support for real demographic trends and should not be dismissed.

In my opinion, the role of excavation is crucial in adequately substantiating population estimates made from surface evidence. Chapman (this volume) illustrates this very well by the problems associated with dating drystone structures and assessing palimpsest effects. Some survey practitioners, particularly in Greece where permits are difficult to attain, have insisted on the independence and purity of Mediterranean survey. In reality, site formation processes are crucial to the understanding of surface remains and it is only through selective excavation that conclusions from surface remains can be substantiated (eg. Stoddart and Whitehead, 1990). Excavation is the means for establishing locally relevant formulae for converting sherd spreads into demographic density; cultural and natural factors should be expected to vary between regions.

Demographic reconstruction remains uncertain at a detailed level. Broadly independent cross-checks can be applied, but they remain subjective but explicit adjustments. The only solution is to explore the effects of different estimates and present the alternatives. Wilkinson (this volume) shows that certain trends appear in data whatever the alternative forms of adjustment and presentation. This gives confidence that, at an appropriate level of generality, demography can be reconstructed from survey evidence.

PATTERN AND EXPLANATION OF DEMOGRAPHY

A major conclusion of the Durham conference was that demographic curves can be presented and should be accompanied by explicit and interdisciplinary statements on the reasoning by which interpretations of these demographic levels were reached (Wilkinson, this volume; Perkins, in press; Cambi, this volume; Novacović, this volume; Trément, this volume). Perkins (in press) has been able to indicate rates of growth, densities of occupation and the proportion of the population in town and country. Some of these conclusions may have to be revisited in the light of the survey sampling strategy, but, at least, the level of explicit explanation of the underlying assumptions makes this possible. A similar explicitness and presentation of detail by Wilkinson (this volume) allows a reconstruction of two cycles of growth from the Near Eastern evidence. These examples raise the important question of the distinction between site numbers and degree of nucleation (Wilkinson, this volume; Trément this volume). A decline in site numbers may well be compen-

sated for demographically by a shift in population focus, resulting in the same aggregate population level of town and country taken together. Survey archaeologists must not be swayed by their success in the recovery of rural sites into thinking that these represent the full demographic pattern.

Unaligned cycles of demographic development can be reconstructed across the Mediterranean. Fluctuations will to some extent be dependent on the scale of the area under study (Wilkinson, this volume), since state management of populations and local crises may be important factors. Small areas will be more subject to change than large regions, which will generally absorb pressure on demography more readily. On the other hand certain areas of the Mediterranean clearly had low levels of population density over long historical trajectories, and these can now be picked up through survey: Langadas (Andreou and Kotsakis, this volume); Gubbio (Malone and Stoddart, 1994). The rich mosaic of Mediterranean demography is becoming apparent, and it is only archaeological survey that can achieve this.

The interpretation of these patterns is a further level of complexity which was not avoided by the presented papers. The changing capacity to mobilise manpower is a major issue in the political development of the Mediterranean. However, if there is no sense of the potential pool for control and mobilisation, many fundamental issues cannot be addressed. Zubrow (this volume) presents the base line from which to work. Chance is examined as a factor in demographic change. It is on this base line that constraining functions of increasing complexity can be applied, including forced austerity and the moulding of geographical boundaries. Wilkinson (this volume) has attempted to look at some of these principles at the micro-level, assessing population growth against production levels and climatic change. Bintliff (this volume) presents general models which may explain different demographic levels in the Mediterranean. In certain periods, the model of core and periphery appears to go some way towards explaining the relationship between early city states and the less developed *ethne* on their flanks. However, there is still considerable academic debate over explanations of apparent demographic trends. Different models almost certainly have a greater or smaller relevance according to the scale of analysis, and studies such as that of Trément (this volume) provide the detailed basis for the reconstructions of different demographic rhythms sensitive to the scale of analysis.

THE RECONSTRUCTION OF HISTORICAL DEMOGRAPHY: THE PRESERVE OF HISTORI-CAL GEOGRAPHY ?

If one turns to any standard historical geographical text, one finds attempts to extend demographic reconstruction back into periods where geographers rarely have first-hand experience. In some cases the attempt is at a level and scale of generality that allows the imposition of a theoretical model of slow growth for what is described as the primary cycle (McEvedy and Jones, 1978). The cycle operated within the limits of the "technology of the time". More recently geographers have attempted to employ archaeological evidence from some of the most celebrated archaeological surveys (Whitmore *et al.*, 1990). However, these attempts lack the sophistication and methodological knowledge that archaeologists can provide.

Archaeologists should not let the field of action fall out of their hands. The data exist to provide the subtleties of broad inter-regional comparison. These subtleties must be explored by those who know the sampling problems, and who have first-hand experience of the critical stages of demographic reconstruction employing archaeological evidence. They would do well to explore the procedures outlined by Sbonias and carefully followed by the contributors to this volume.

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10. Chance and the Human Population: Population Growth in the Mediterranean

Ezra Zubrow and Jennifer Robinson

INTRODUCTION

Population groups of a thousand or less, which for purposes of this paper will be called "small populations", are the norm for many prehistoric societies. Village life which began at least 9 millennia ago has continued in many rural areas up to the present. Understanding the long-term record of such cultures and the transition from village to town life requires a basic understanding of the demographic history and potential of small populations. For these hamlets and villages the issues of stability and instability of small populations (Zubrow, 1976), the implications of interactions of populations on growth (Zubrow, 1990a), and the spatial characteristics of repetitive depopulation are important (Zubrow, 1990b). Numerous authors have written on small population dynamics, including the classic studies of Acsadi and Nemeskéri (Acsadi and Nemeskéri, 1970) and Black (Black, 1978) The authors (Robinson, 1980a; Robinson, 1980b; Zubrow, 1991) have had a long term interest in the impact that chance has on the growth of small populations.

THE PROBLEM

In the early 1960's, Robert MacArthur suggested that, all else being equal, the time to extinction of small populations (i.e., less than 150) is short, on the order of a few years. Once a population reaches a considerable larger size, such as 1000, the time to extinction is almost infinite. MacArthur, who is most famous for work on island biogeography (MacArthur and Wilson, 1967), published this assertion with reference to isolated animal populations, and as far as the authors are aware, applied it to the demography of small human populations only in graduate seminars. Nonetheless, the concept that small populations are unviable has become standard in the demographic and anthropological literature. For example, Ward and Weiss (Ward and Weiss, 1976) state:

> '...if the first assumption were true then the vital rates would be subject to chance fluctuations about these expected values to the extent that small populations with more extreme fluctuations would be highly susceptible to chance extinction. With fluctuations in both birth and death rates as populations become small, there is always the chance that every member of the population will die without issue. If we add to this the increasing restriction in eligible mates as a consequence of decreasing size in a population with various marriages being prohibited, then the likelihood of the continued existence of human population groups smaller than 200 becomes small indeed. However, such populations do survive and do exhibit variability in birth and death rates.'

This volume is concerned with the demography of agriculture in the Mediterranean. In this region the transition to successful agriculture involved both a technological and a demographic revolution. Large numbers of families lived in rural or village settings. The size of communities is thought to have increased from approximately 100 to more than 1000. For example, Walker and Perkins reconstruct the demographic history of the Albegna Valley and Ager Cosanus in Tuscany. They suggest that in the VII century BC there were 220 rural families and no urban families, while by VI century BC the distribution has reversed with 397 rural families and 1000 urban families (Perkins, in press; Walker, in press). If the standard dictum is correct, this transition with its corresponding changes in rural and urban technology should have brought a significant reduction in the probability of extinction. However, the direction of the causal arrow between technology and resources, on the one hand, and population growth, on the other, is not clear. There is still no general consensus, and the famous debate symbolized by Malthus (Malthus, 1807) and Boserup (Boserup, 1965) continues to rage. Whether population growth is limited by resources and technology or whether it intensifies labour input and promotes economic growth appears to depend upon the time, the population, and the scholar.

In either case, it has been suggested that high fertility

and the resulting large family size contributes to the continuing survival of small populations. For example, Goody and Harrison (Goody, 1976; Goody and Harrison, 1976) show that if there is a .3 probability of a child dying before the father and the family size is 2.5, there is almost 1 chance in 5 that there will be no surviving children. If one increases the family size to 6, the percentage decreases to 1 chance in 50. In other words, the addition of one person increases the probability of survival for the family ten times.

To understand the change in agricultural populations over three millennia around the Mediterranean, one must first find out whether small populations really have a chance of survival. In other words, the question asked is simply: do small populations have a high probability of going extinct under the early agricultural demographic conditions?

METHODOLOGY

The methodology used is direct and robust. It consists of undertaking large numbers of experiments under different demographic scenarios through simple simulations. The units of study are small villages with different initial sizes. One imposes large amounts of chance variation to fertility, mortality, in-migration and out-migration rates and tracks the outcomes over thousands of years. Initially, age-specific rates were used but it was found over long periods of time that crude-rates are almost as effective as indicators, require fewer assumptions, and provide almost the same results. Meadows came to a similar conclusion in comparing age-structured and aggregate population models (Meadows, 1974). Therefore, in this short paper, the discussion will be confined to the crude rate model. The model is based upon adding chance to the simple population equation.

Model

All simulations were programmed in the Interactive Data Language (IDL is a trademark of Research Systems Incorporated of Boulder, Colorado). The model used is one of simple demographic accounting, and may be reduced to two do-loop expressions as follows. Base fertility, mortality, inmigration, and outmigration rates are provided to the program as is the beginning size of the hamlet or village. These initial values are based upon ethnographic and archaeological estimates. They are made to vary randomly on an annual basis through multiplication by r, a draw from a uniform distribution between 0.5 and 1.5. Different random series are used for fertility, mortality, inmigration, outmigration, and population. The process is repeated annually and for different initial values for village population.

```
for i=0,lim2 do begin
pop=fltarr(lim+2)
newfert=fltarr(lim+2)
newmort=fltarr(lim+2)
```

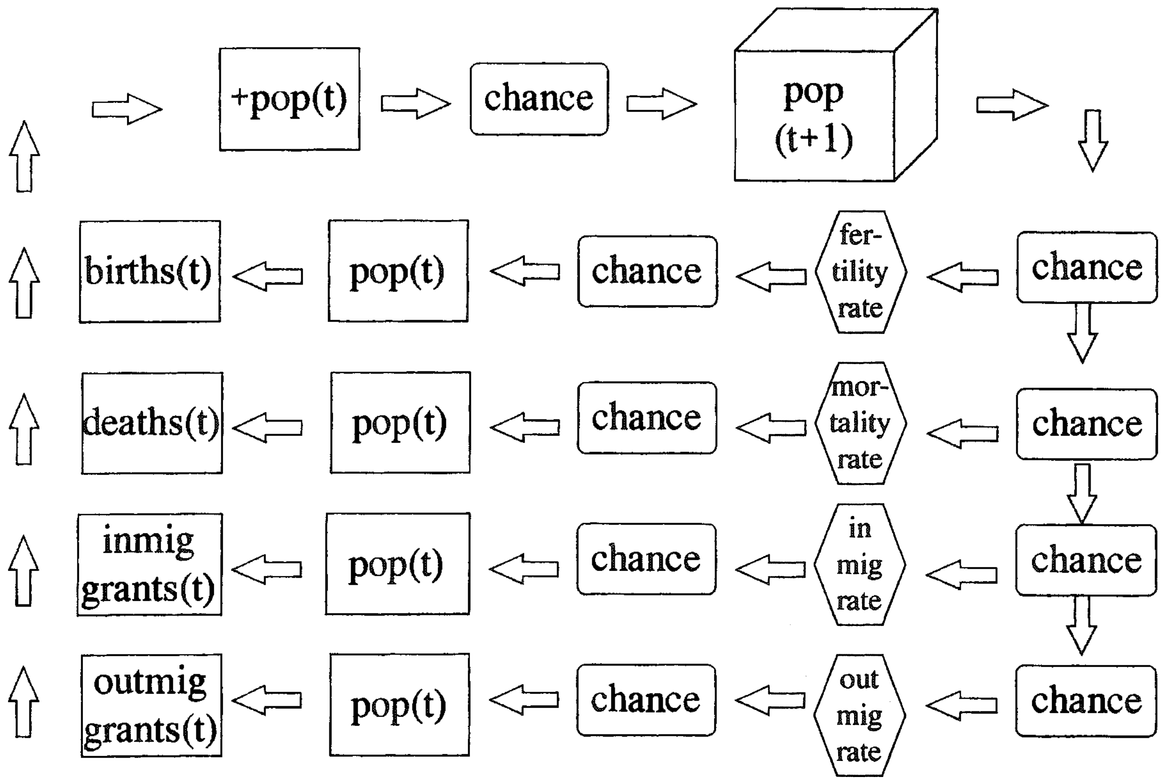

Figure 10.1. Population Model with Robust Chance: The simulation model.

```
newinmig=fltarr(lim+2)
newoutmig=fltarr(lim+2)
pop(0)=popinit
for n=long(0),lim do begin
r=randomu(seed,5)
newfert(n+1)=(fert+fert*r(1))
newbirths= (pop(n)*(newfert(n+1)))
newmort(n+1)=(mort+mort*r(2))
newdeaths= pop(n)*newmort(n+1)
newinmig(n+1)=(inmig+inmig*r(3))
newinmigrants=pop(n)*newinmig(n+1)
newoutmig(n+1)=(outmig+outmig*r(3))
newoutmigrants=pop(n)*newoutmig(n+1)
pop(n+1)=pop(n)+newbirths-newdeaths$
+newinmigrants-newoutmigrants
endfor
endfor
```

In graphic form the model is presented in Figure 10.1.

Parameter estimation

Grigg (Grigg, 1980) indicates that between AD 1450 and 1600, the crude rates of population increase in rural Europe ranged from 1.1% per annum to -.12 % per annum. He suggests rates of .25% to .82 % for the later centuries, by which time the industrial revolution has significantly changed the rural demographic landscape. These figures correspond with many figures developed by Wrigley, Smith, Laslett, Schurer and others at the Cambridge Group for the Study of Population and Social History for English populations as well as Las Bras for the analogous European populations. Thus, we will limit our rates of change to being no more than .003 and more frequently .001.

The highest documented rates of human fertility are from the Hutterite populations. These rates range from 0.04 to .0440 per annum. Combined with low mortality, this often leads to completed family sizes of 11 or more children (Stephenson, 1991; Hostetler, 1974; Eaton and Mayer, 1954).

None of these parameters was associated with constant growth rates or monotonic population increase. Figure 10.2 shows Grigg's (Grigg, 1980) and Colin Clark's (Clark, 1967) population of primarily European countries which border the Mediterranean from the time of Christ to AD 1800–1900. The variation in growth is apparent. Figure 10.3 aggregates the data from Europe and contrasts them to the North African data, and thus points out how different the demographic history around the Mediterranean could be. Figure 10.4 shows the changing population growth of Hutterite communities. Most of the settlements were less than 150 people.

Given the above, this study constrained growth by the approximate limits i.e. ± .003. Within this constraint, the vital and migration rates were allowed to vary between .01–.04.

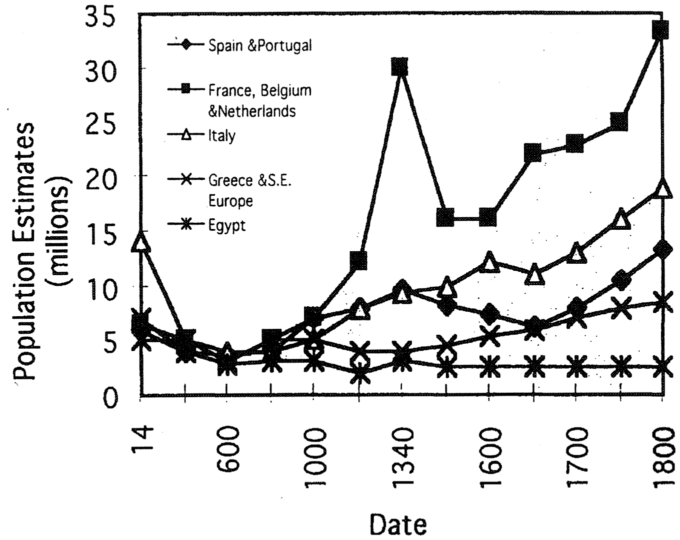

Figure 10.2. Mediterranean Populations by Country by Time: The changing population of primarily European countries facing the Mediterranean 0–1800 AD.

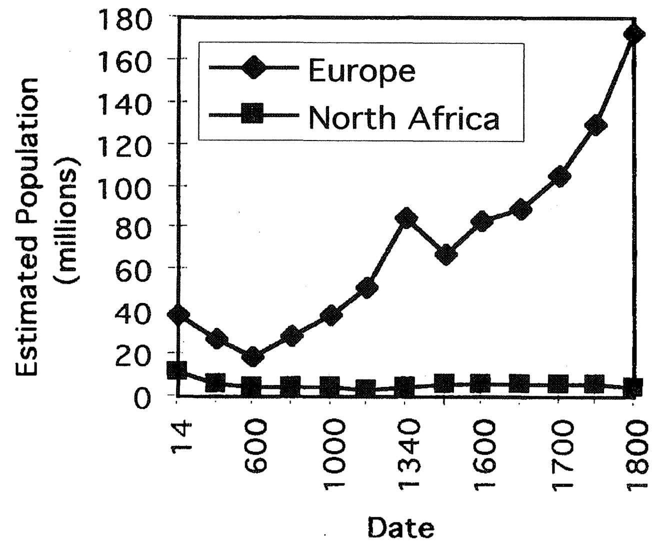

Figure 10.3. Mediterranean Populations by Date: Comparing European and North African demographic history 0–1800 AD.

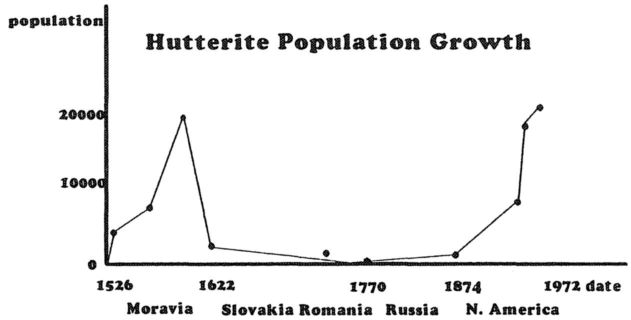

Figure 10.4. The Hutterite population from 1528–1972.

THE RESULTS

Individual villages

The results of the model simulations are presented below in a series of scenarios of increasing size and complexity. Figure 10.5 shows population change for a village whose initial population is 100 and whose fertility, mortality, inmigration, and outmigration are initially are all set to .04. Thus, all the change is taking place by chance. In this particular example, the population slowly grows over the 100 year period, with some ten or so bumps caused by chance differences in the vital and migration rates as well as the impact of chance on the population. The

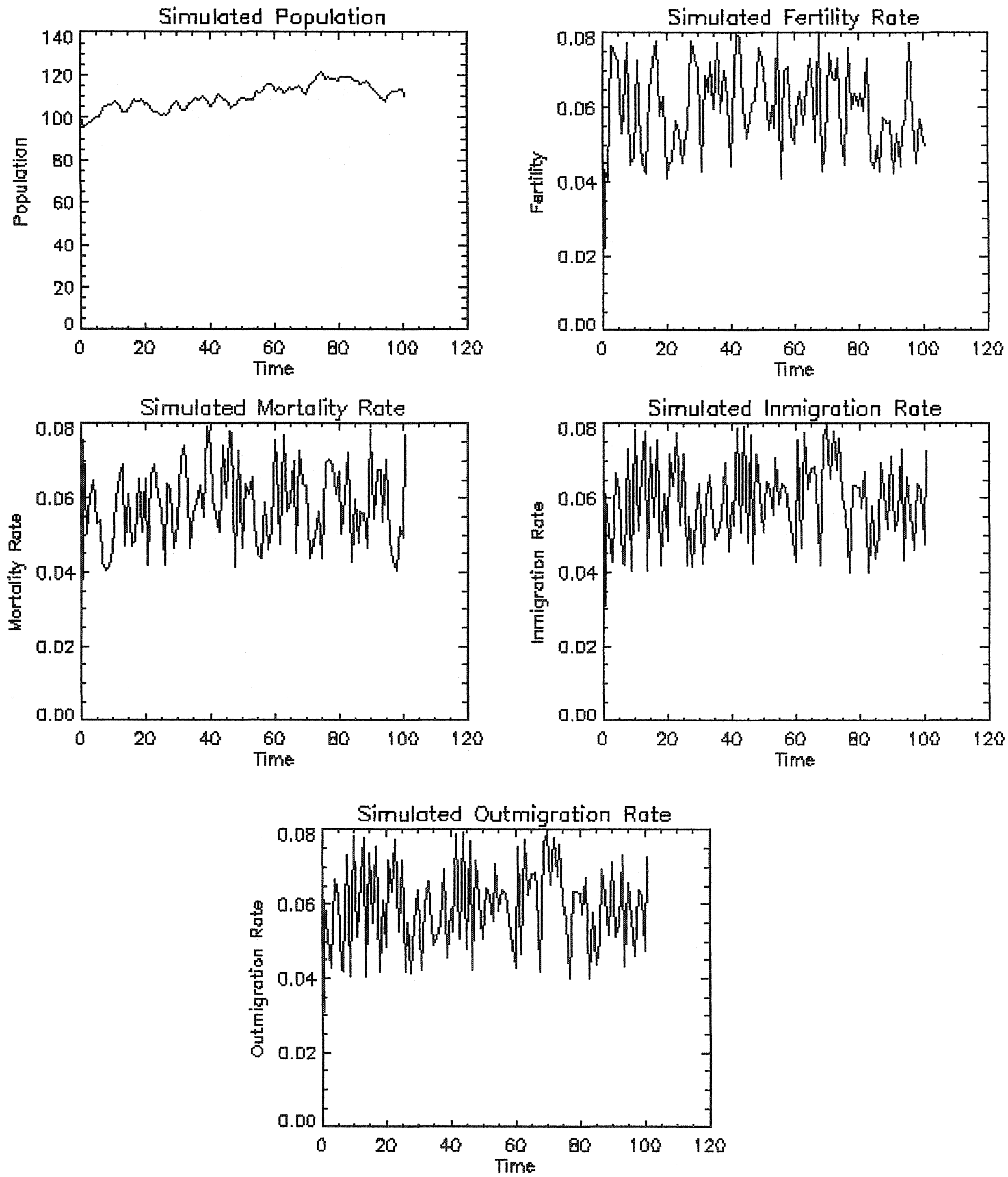

Figure 10.5. 100 years of growth for even parameters of fertility .04, mortality .04, in-migration .04, outmigration .04. 5a. Simulated village population by time; 5b. Fertility rates by time; 5c. Mortality rates by time; 5d. In-migration rates by time; 5e. Out-migration rates by time.

disaggregated rate graphs show the impact of chance on these parameters.

Increasing the length of time that the village may last to 1000 years, with the same fertility, mortality, migration and mortality rates, results in Figure 10.6. Again chance causes all the changes. The population follows an irregular path reaching 190 people in one thousand years, in comparison to 120 people in one hundred years in Figure 10.5. In addition to the overall trend of growth, one can see three or four cycles of approximately two hundred years.

A frequent scenario which we shall call the colonizing scenario is when fertility is slightly above mortality (.0441 >.038) but inmigration is sufficiently less (.038) than

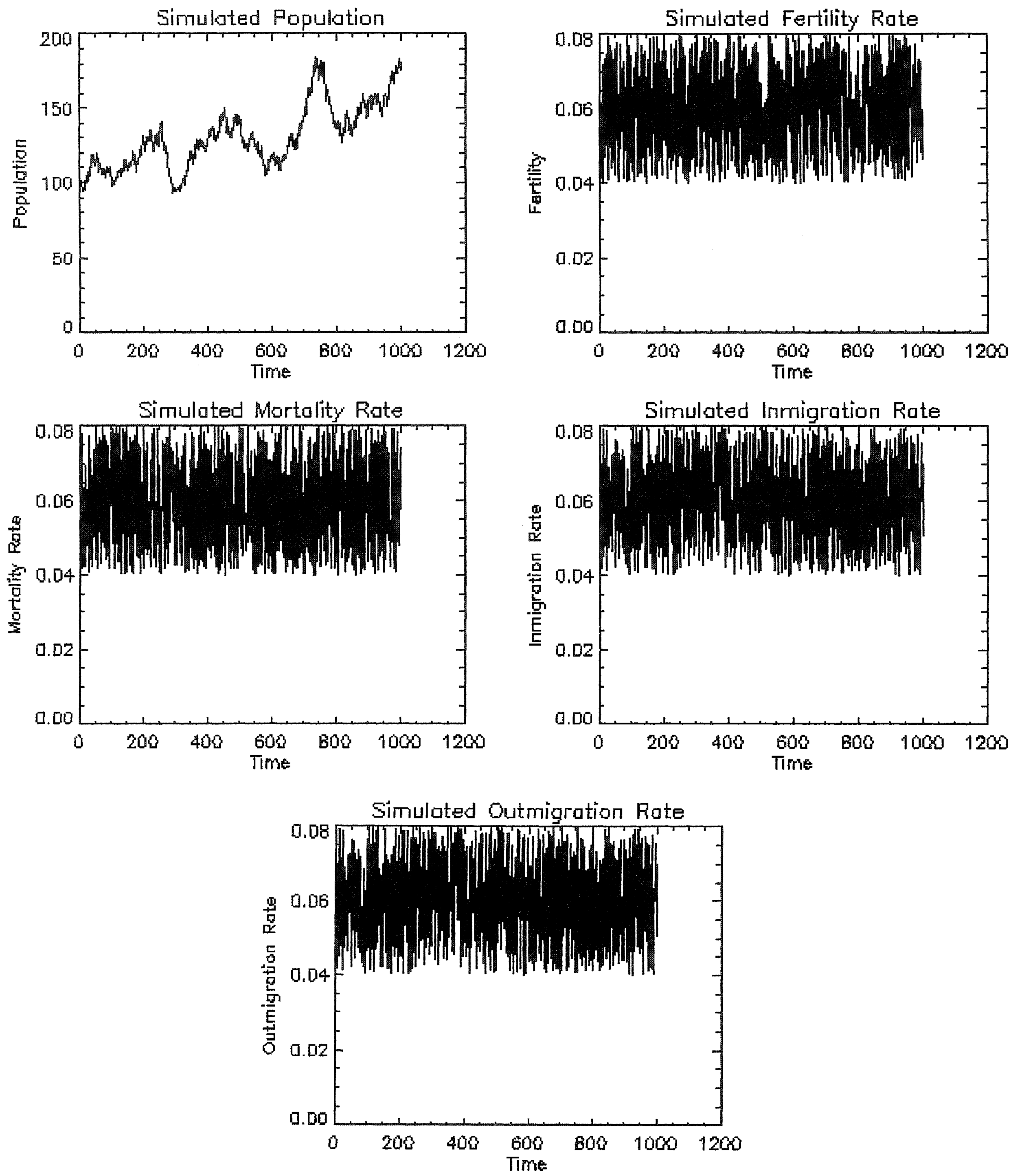

Figure 10.6. The impact of chance on a village over 1000 years of growth. The parameters are fertility .04, mortality .04, in-migration .04, outmigration .04. 6a. Simulated village population by time; 6b. Fertility rates by time; 6c. Mortality rates by time; 6d. In-migration rates by time; 6e. Out-migration rates by time.

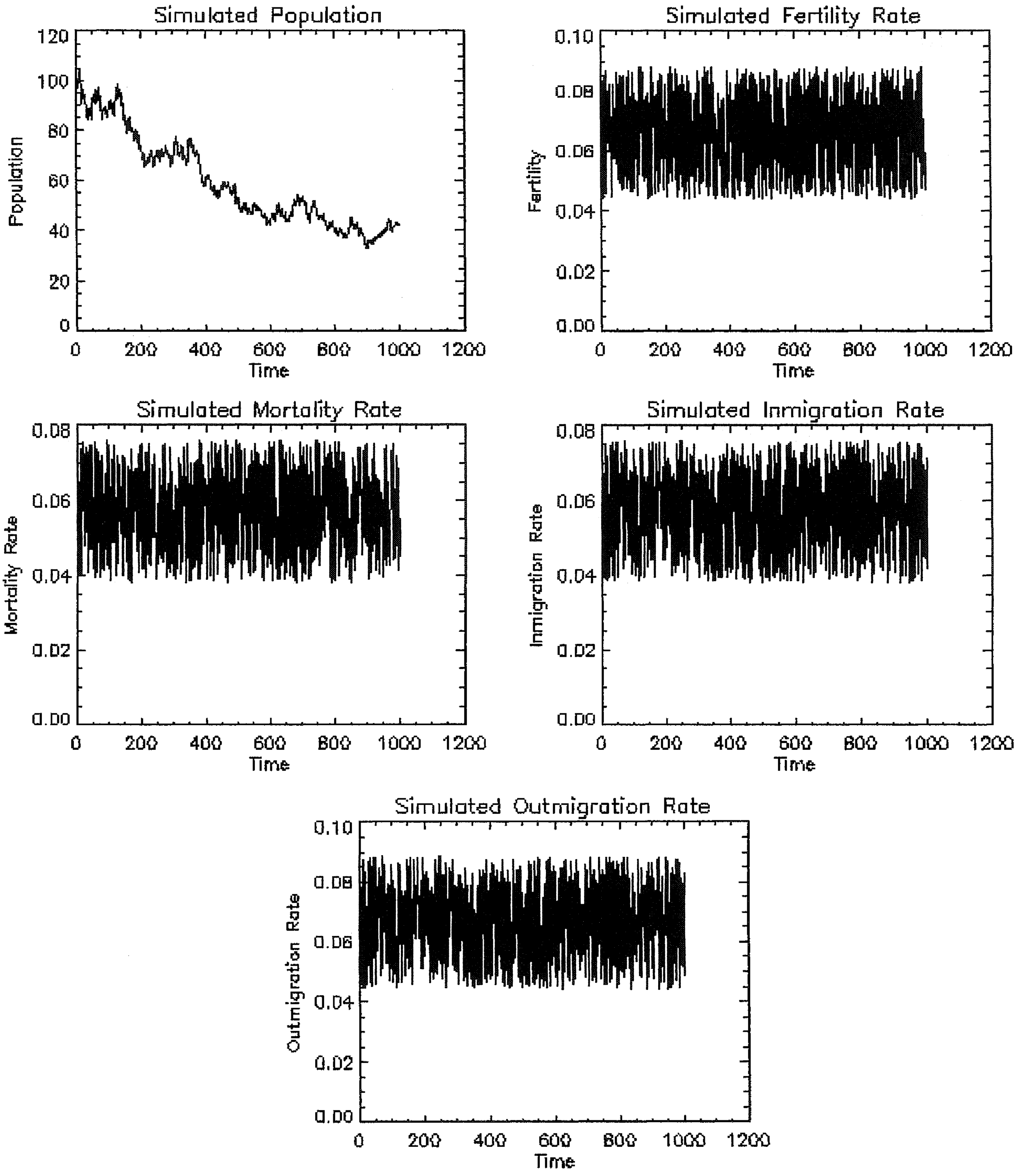

Figure 10.7. The colonizing scenario for 1000 years where outmigration is critical. The parameters are fertility .0441, mortality .038, in-migration .038, out-migration .0442. 7a. Simultaed village population by time; 7b. Fertility rates by time; 7c. Mortality rates by time; 76d. In-migration rates by time; 7e. Out-migration rates by time.

outmigration (.0442) so that colonization takes place which may eventually impact the donor village. This is shown in Figure 10.7 where after 200 years the population of the donor village begins to seriously decline. The population drops rapidly to 70 where it stabilizes for two centuries and then decreases erratically to approximately 40.

Similarly, we considered the population which simply had higher mortality than fertility rates. Figure 10.8 is thus called the extinction scenario. Fertility is .037, mortality, .04, in and outmigration are .038. Extinction

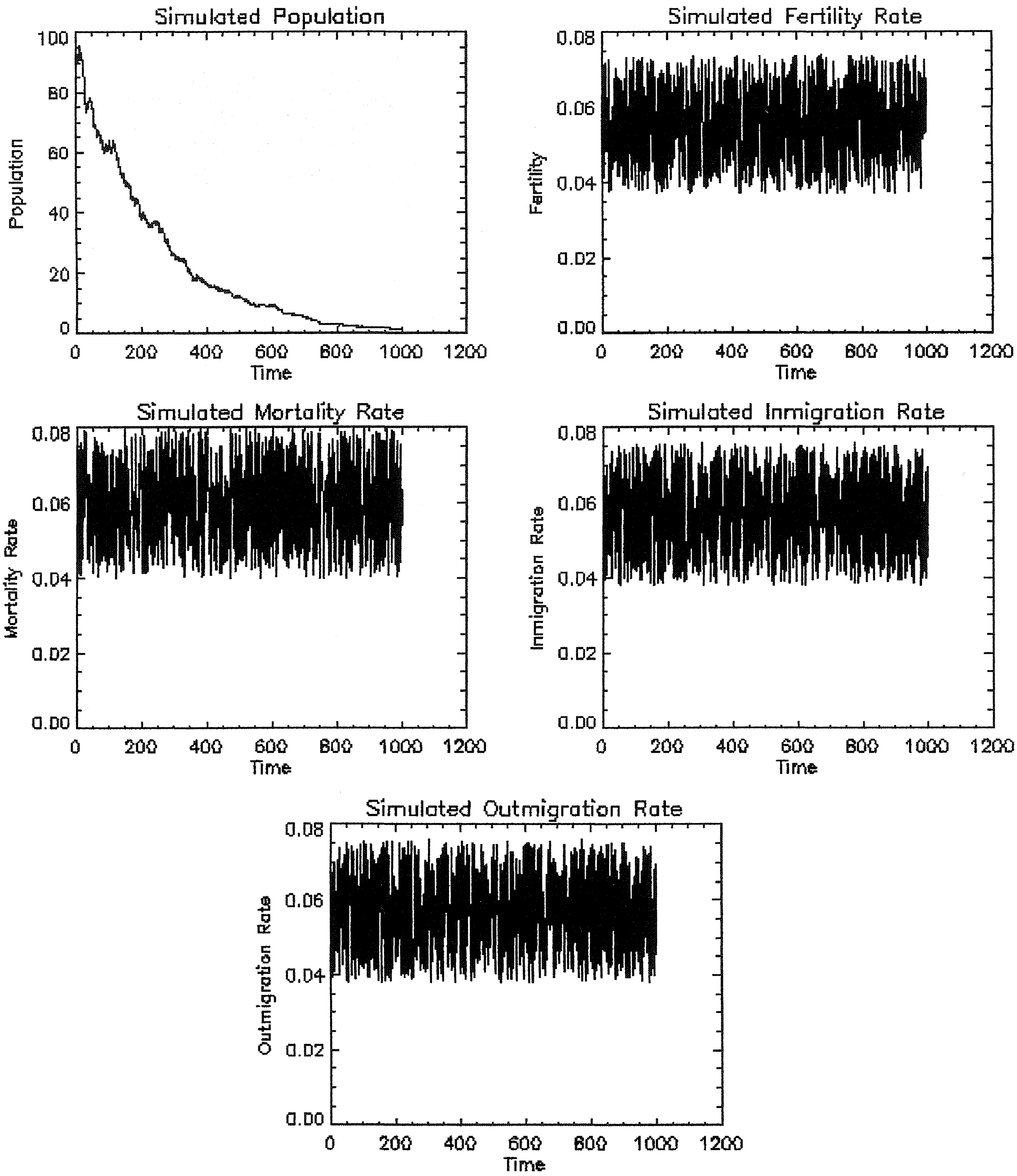

Figure 10.8. The extinction scenario: The parameters are fertility .037, mortality .04, in-migration .038, out-migration .038. 8a. Simulated village population by time; 8b. Fertility rates by time; 8c. Mortality rates by time; 8d. In-migration rates by time; 8e. Out-migration rates by time.

occurs with the millennium for the village. Depopulation takes place rapidly in the first few centuries and then continues inexorably at a much slower rate. There are only a few decades when the depopulation is halted. One occurs at 100 and one at 600. Combining these rates with higher outmigration than inmigration rates creates extinction several centuries earlier.

Figure 10.9 shows the growth scenario. This model would correspond to the initial stages of transition theory with very high fertility, very high mortality, as well as

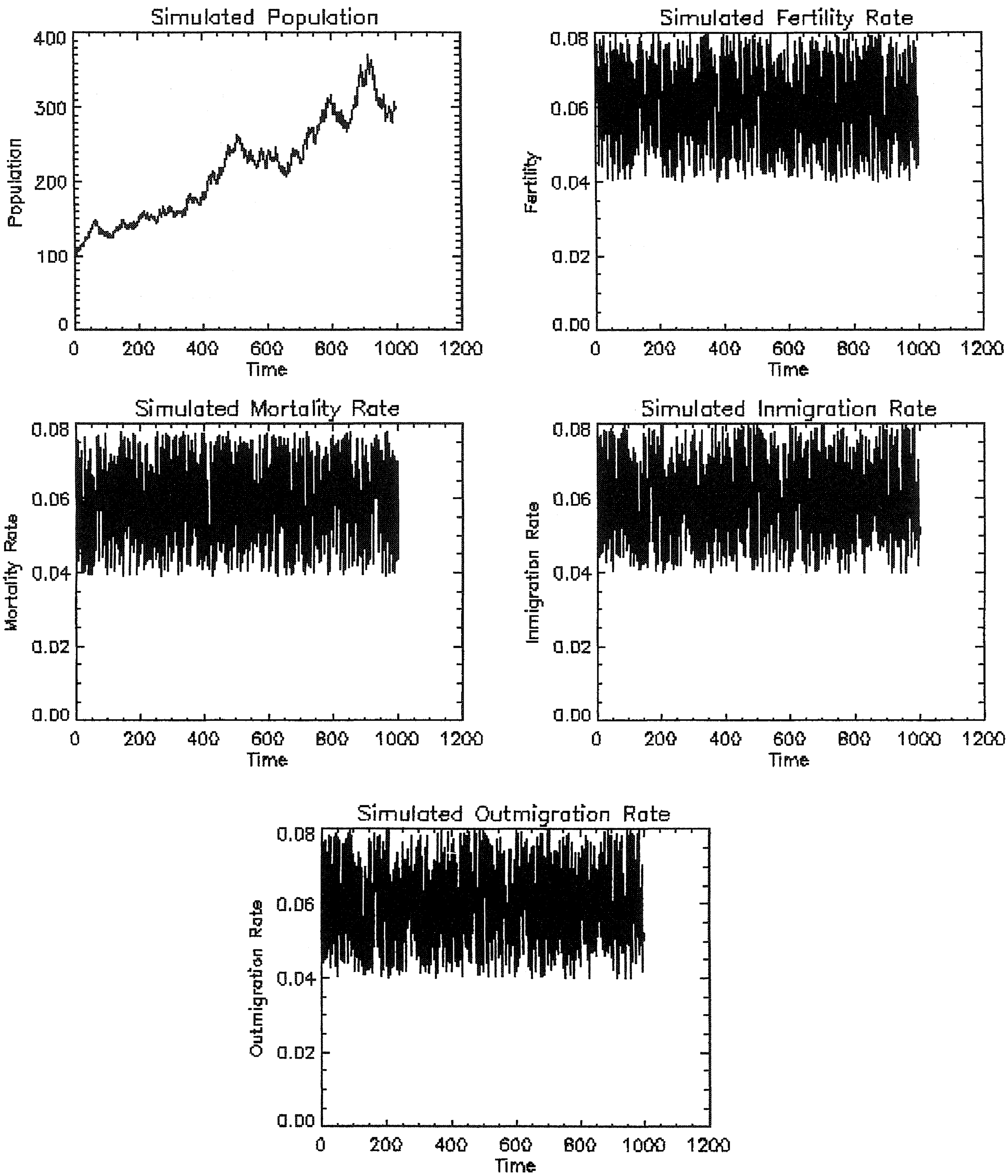

Figure 10.9. The growth scenario: The parameters are fertility .040, mortality .037, in-migration .04, out-migration .04. 9a. Simulated village population by time; 9b. Fertility rates by time; 9c. Mortality rates by time; 9d. In-migration rates by time; 9e. Out-migration rates by time.

high inmigration and outmigration. The population grows to almost 380 before dropping back to 300. The growth pattern is somewhat irregular with three large cycles lasting approximately two centuries.

Multiple Villages

Of course, the above represent individual simulation results, in as much as each simulation tracks the history of a single village which begins at a population of 100.

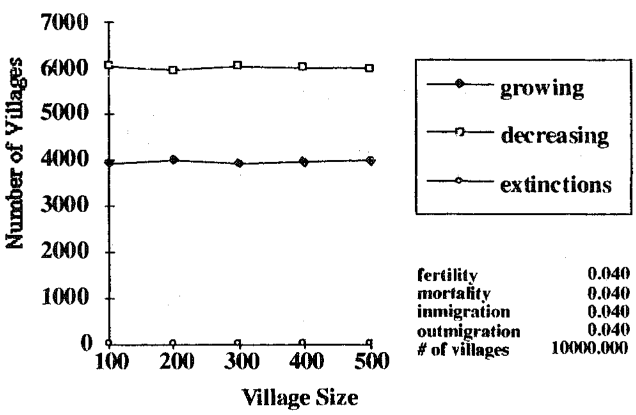

Figure 10.10. 50,000 villages – no extinctions in 1000 years.

Agricultural villages dotted the landscape of the European Mediterranean. Each had its own population–time trajectory. What kinds of patterns should there be? What are the expectations in the aggregated numbers of growth, decline and extinction for these thousands of villages over several millennia?

The most important of the results follows. Consider fifty thousand villages along the Mediterranean, of which ten thousand have a population of 100; ten thousand a population of 200, ten thousand a population of 300, ten thousand a population of 400, and ten thousand a population of 500. The fertility, mortality, inmigration and outmigration rates are set equal at .040. This is just below Hutterite norms. One would expect more extinctions with smaller initial populations. However, not one of the 50,000 villages went extinct. One might suggest that chance does not play the role that anthropological demographers have suggested. In any case, the results of these simulations are shown in Figure 10.10 immediately opposite. As one may see, there are no extinctions indicated on the graph. With regards to growing or decreasing populations, the reader should be careful, for the graph has the potential of being misleading. The definition of growing is that the final population is greater than the initial population, and the definition of decreasing is that the final population is smaller than the initial population. Thus, a population could be less than the initial population for 900 years but grow rapidly for the last century and be counted as an increasing population. Conversely, the same misinterpretation is possible for a population which increases for a long period and then decreases beyond the initial population at the end of the sequence. Another misleading aspect of the following graphs is the problem of summation. The number of decreasing and growing villages should equal the total. However, the number of decreasing villages and extinctions does not. All villages that become extinct also are decreasing. Thus, they are in some sense double counted.

Next, are these results an artifact of the relatively high vital and migration rates? The answer is no. Figure 10.11 shows the results of simulating another 40,000 villages. 10,000 were simulated with vital and migration rates set to .01; 10,000 were simulated with vital and migration rates set to .02; 10,000 with rates set to .03; and 10,000 with rates at .04. In each of these cases the initial populations of the villages were 1000 villages with 100 people, 1000 villages with 200 people, etc. Chance is not sufficient to create any extinctions. Essentially the same

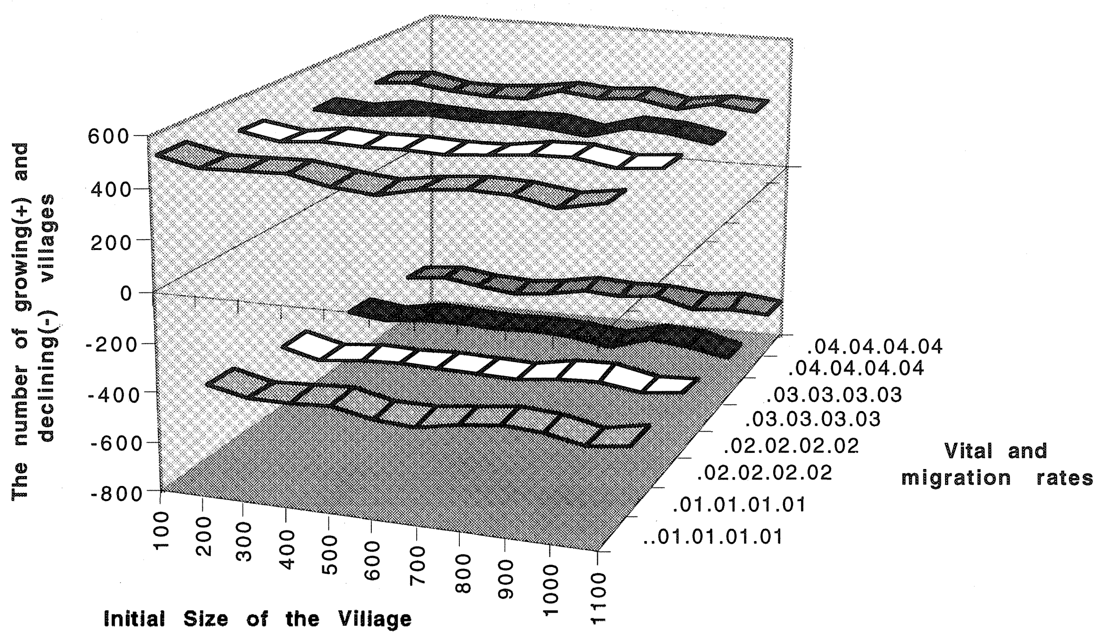

Figure 10.11. The impact of chance on the growth and decline of 40,000 villages over 1000 years. The demographic regimes are set so that before chance r=0 and the vital and migratory rates are equal between .01–.04.

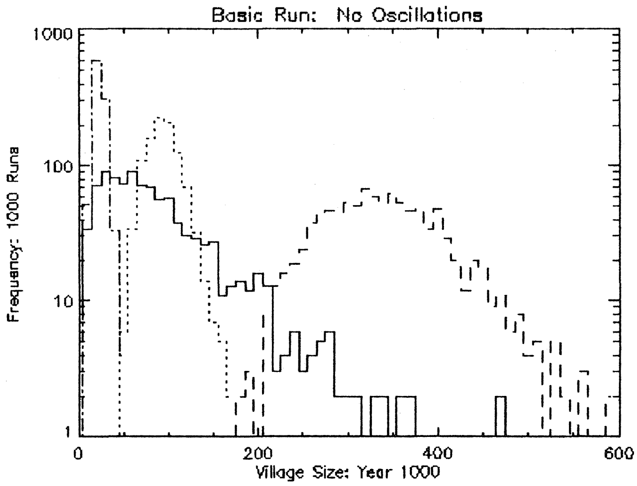

Figure 10.12. Frequency distribution of village sizes after 1000 years of simulation for 1000 runs each of four scenarios. Solid lines, rapid rate scenario (mean birth, death, inmigration, and outmigration, respectively of 0.04, 0.04, 0.04, and 0.04), dotted lines, low growth scenario (0.01, 0.01, 0.01, and 0.01), dashed lines, low growth with enhanced fertility (0.0125, 0.01, 0.01, and 0.01) and dot-dash lines, low growth with enhanced mortality (0.01, 0.0125, 0.01, and 0.01).

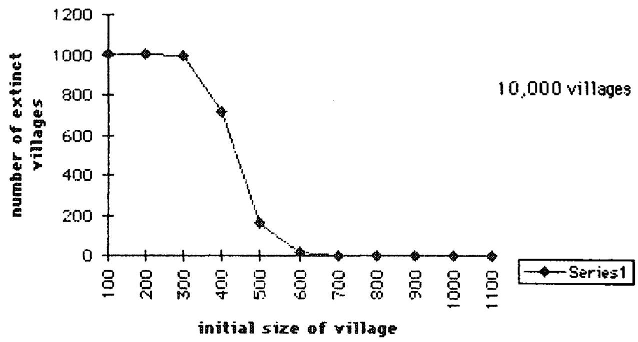

Figure 10.13. The extinction scenario for 10,000 villages: the number of villages which become extinct by their initial size under the demographic regime of fertility=.01, mortality=.0125, inmigration=.01, outmigration=.01.

patterns of growing and declining villages may be seen.

In general, it is interesting to note that the number of declining villages is greater than the number of growing villages. Typically a 60–40 ratio. There is a larger number of villages with smaller populations and a smaller number of villages with larger populations. Thus, when the demographic parameters are equal the system remains in balance. Figure 10.12 shows the frequency distribution of population by villages at the end of a 1000 year simulation.

The extinction scenario may be forced to occur by setting the parameters appropriately for numerous villages as well as for individual villages. The next Figure (10.13) shows the number of extinctions for 10,000 villages distributed by size over 1000 years. In this case, the original hypothesis that small villages are more susceptible to extinction than large is borne out.

In short, extinction may be forced by long term sustained net imbalance of parameters. However, the demographic systems are very robust and chance is not sufficient even for small populations to create large number of village extinctions.

Patterns of Chance

"in the seven years of plenty the earth brought forth in heaps... and the seven years of famine began to come according as Joseph had said and there was famine in all the lands...". *Genesis* ch. 41 verse 47 and verse 54

Agricultural populations roll dice with nature. Thus, one might ask whether streaks of chance will break the demographic bank.

The next experiment examines amplification and patterned oscillation of chance, and its effects on both the demographic rate parameters and the village populations. Biblically, seven years of plenty are followed by seven years famine. Here, one examines a 10 year peak to trough oscillation which is roughly similar to a 10 year streak alternating between good and bad luck. It amplifies the "good" and the "bad" from 0 to 2 times as shown in Figure 10.14 below. This experiment was done both synchronously (positive rates and negative rates were amplified simultaneously) and asynchronously (positive and negative rates were amplified out of phase). The pattern was created by multiplying the chance in the previous experiments by a sine or cosine wave. In the synchronous experiment chance was compounded by a sine wave being applied to the vital and migratory parameters. In the asynchronous experiment, the product of chance, fertility and in-migration was multiplied by a sine wave, while the product of chance, mortality and outmigration rates was multiplied by the cosine.

Our translation of Joseph is seen below (Figure 10.15) where the amplification of good and bad clearly fluctuates with a 20 year cycle. It is worth noting that the superimposition of the smooth sine wave and the annual fluctuation results in considerable spikiness.

Figure 10.16 shows the frequency distribution of the forcing function of the experiment applied in a thousand years of simulation to a thousand villages. It is almost indistinguishable from Figure 10.11 which shows the same distributions without the application of the sine wave.

Numerous other runs were undertaken using different frequencies of sine waves and applying them in different combinations of parameters. The statistical results from four of these experiments are shown in Table 10.1. In no case did this result in massive or even very many ex-

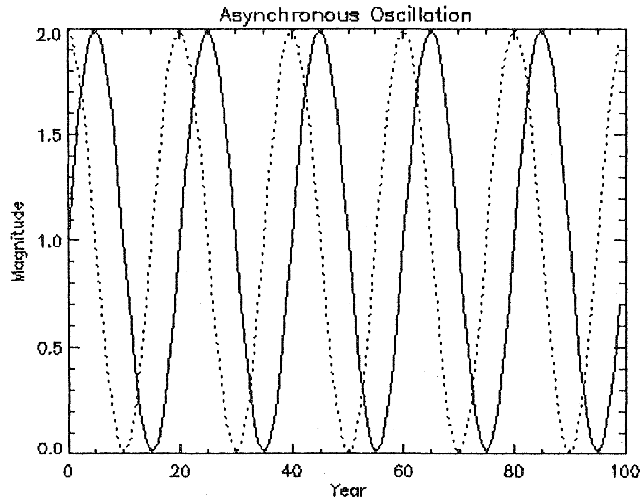

Figure 10.14. Forcing functions for patterned chance. In the synchronous case, the value of the solid line would be applied to all demographic parameters. In the asynchronous case, both functions are used. Fertility and in-migration by values along the solid line and mortality and out-migration by values along the dotted line.

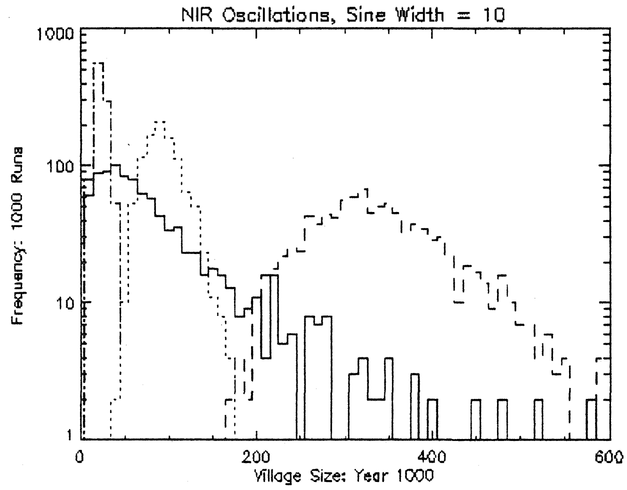

Figure 10.16. Frequency distribution of village sizes, after 1000 years of simulation for 1000 runs, each of four scenarios, with the application of the sine wave to all rates and chance. Solid lines, rapid rate scenario (mean birth, death, inmigration, and outmigration, respectively of 0.04, 0.04, 0.04, and 0.04), dotted lines, low growth scenario (0.01, 0.01, 0.01, and 0.01), dashed lines, low growth with enhanced fertility 0.0125, 0.01, 0.01, and 0.01) and dot-dash lines, low growth with enhanced mortality (0.01, 0.0125, 0.01, and 0.01).

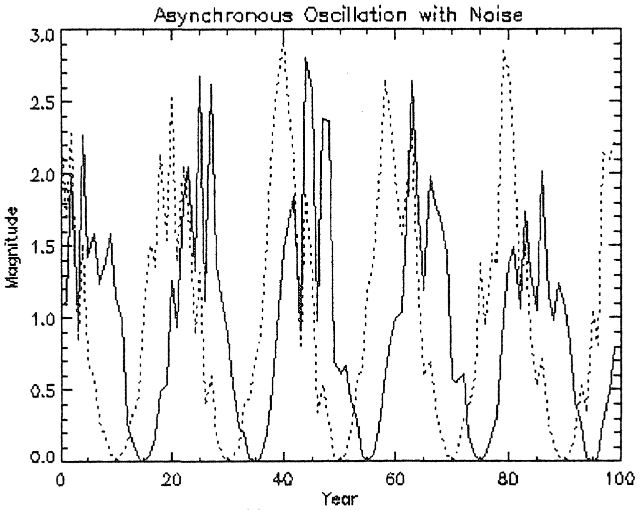

Figure 10.15. Pattern chance – ten years of demographic plenty and ten years of demographic famine.

B:D:IN:OUT	r 4:4:4:4	k 1:1:1:1	k+1.25:1:1:1	k- 1:1.25:1:1
Mean	101	100	349	29
Standard Deviation	672	94	365	30
Number of Extinctions	2	0	0	0
Sine on Births, Width 10				
Mean	93	100	348	29
Standard Deviation	84	20	76	6
Number of Extinctions	10	0	0	0
Sine on Net Increase Rate, Width 10				
Mean	96	99	346	28
Standard Deviation	99	22	82	7
Number of Extinctions	26	0	0	0
Asynchronous Amplification of Birth and Inmigration vs. Death and Outmigration, Width 10				
Mean	43	95	330	27
Standard Deviation	49	21	78	6
Number of Extinctions	157	0	0	0

Table 10.1. Statistical outcomes of four demographic scenarios under four different external forcing patterns.

tinctions. The few extinctions which did occur were in the high (.04) parameter case. Otherwise it does not appear to make any significant changes.

There is little apparent difference between the synchronous and asynchronous, except for the number of extinctions for the .04 scenario, in which case even the otherwise highly stable mean is brought down.

The inferences which are to be drawn from these experiments, however, are startling. The assumption had been that the repetitive high birth rates or high mortality rates, like Joseph's periods of plenty or famine, would destabilize the general pattern of growth. In other words, one might expect frequent patterns of continuous higher mortality to raise extinction rates. However, to the contrary

the structure is extraordinarily robust. Periodic frequent increases in mortality are saved by periodic frequent increases in fertility, and vice versa. These conclusions pertaining to random variation in demographic variables can be extended to situations of imposed external forcings, such as the 10–20 year climatic or agricultural oscillations.

CONCLUSIONS

The major conclusion is that village extinction for small populations is far more rare than the archaeological and anthropological literature suggests. In fact a robust chance model shows that for large numbers of small villages over long time periods, chance is not sufficient to cause extinction. Once a village is located and reaches a population of 100, there is a far better possibility that it will continue to exist and increase or decrease, rather than become extinct. Even smaller villages in the neighbourhood of 20 seem to be highly persistent. Finally, Joseph is wrong. Repetitive patterns of demographic feast and famine may cause hardship but they do not cause extinction.

It would appear that village extinction is more probably caused by cultural reasons, disease, or warfare. It is not caused by some law of small numbers.

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11. The Potential of Historical Demography for Regional Studies

Malcolm Smith

INTRODUCTION

This paper suggests a number of topics, mostly derived from historical demography, which might be expected to influence the findings and interpretation of regional survey. My own training is as a biological anthropologist rather than as a historical demographer, and this clearly constrains both my interests and my expertise. What I have tried to do in the examples below is to select some topics of importance to biological anthropology which have resonances in population history and demography, and which might have detectable effects on a local or regional scale.

Since the strategy employed is to use historical sources as evidence for the demographic and genetic characteristics of past populations, it is a matter of definition that the equivalent prehistoric evidence is lacking. One is not so much tempted as forced into the position of extrapolating from medieval and later evidence. Such extrapolation is undoubtedly speculative, but if one were not prepared to take this risk there would be no point in the exercise at all. We do have to keep firmly in mind, though, that such an approach is based on data from a rather limited and very particular time-span. Cautious interpretation, then, should certainly be a feature of my treatment of migration, age structure, inbreeding and abandonment. The final topic that I address, namely inference from present-day genetic distributions, is a quite separate issue, with its sources in genetics rather than demography; we shall still need to be cautious, but for other reasons.

MIGRATION

There are a number of sources which can be used to reconstruct movement patterns in historical populations. I am most familiar with English sources and case studies, and will use them here to make the point that there seems to be considerable continuity of migration activity over historical time.

In England we are apt to take a sentimental view of our past, harking back to a golden age of rural tranquillity and idyllic cottage gardens, separated from the present by some Rubicon, the coming of the railways or the Great War, after which the isolation between communities broke down. Before that, we are inclined to think, people were born, lived and died in the same village. This view, however, has been firmly debunked by demographic historians, who have shown from a variety of sources, that as far back as the record exists evidence for mobility is strong. It is a peculiar feature of this "rural idyll" model that however often it is gainsaid, each new generation of historians seems impelled to demonstrate its falsehood (Coleman, 1984).

The sources on which historians have principally relied for forming their view of the demography of historical populations are Nineteenth Century Censuses (Higgs, 1989) and Anglican Parish Registers. For supplying the detail of individual lives the censuses are effectively confined to the period 1841 to 1891. Before that, summary statistics are all that survive, and after 1891 the census enumerators' books are subject to a one hundred year rule of confidentiality. Parish Registers offer a much longer continuity of coverage, from the mid-sixteenth century to the present day. They record what are essentially spiritual events in the life of the parish population, namely baptisms, marriages and burials. These are not quite the same as births, marriages and deaths, firstly because some people may not take part in the registration process at all – for instance Jews, Nonconformists, Recusants etc. – and secondly, because even within the registered population, spiritual events may be displaced in time from the vital events we wish to infer from them. Parish Registers were instituted during the reign of Henry VIII by Thomas Cromwell, though relatively few parishes have records surviving from 1538, the first year of registration. Those that do survive are mostly transcriptions onto parchment of the original and very perishable paper documents. The amount of information is rather variable and often scanty in the earlier periods. It was not until the Hardwicke Act

for the prevention of clandestine marriages in 1753 that marriages were recorded in an ordered printed book with a standardised format. With the Roses Act of 1812, burials and baptisms were also recorded on printed forms. During the nineteenth century, and certainly after the institution of Civil Registration in 1836, incompleteness of Anglican registers becomes a serious problem.

Parish registers reflect the standing population through sampling its vital events as they occur. Thus, one never sees exactly how many adults there are in the population, only how many get married, give birth, or die in any given year. There are two main techniques of analysis, aggregative and nominal (or family reconstitution). Both are well described in Wrigley (1966). Aggregative analysis, which works with annual or monthly totals of individual events, to answer questions such as 'are there more births than deaths every year?' or 'is there a seasonal pattern of marriage?' or even 'on which day of the week did marriages usually take place?', is less labour intensive than family reconstitution. The latter, which requires much greater effort in order to link the events in the life of individuals and families, is ideally suited to answering questions about life histories and family structures. It could be much more widely used in anthropology than it has been.

The most common way of estimating migration from parish registers is through the study of "marriage horizons", a term which refers to the named parishes in the marriage register with which the bride and groom are said to be associated. There are, however, two problems with this method. First, the component of migration reflected in the distance between the birthplaces of brides and grooms may not accurately or even proportionately represent lifetime or generational mobility (Coleman, 1984; Jorde, 1984). Second, there is ambiguity about the exact significance of the parish of affiliation given by the bride and groom at marriage; it may signify the place of birth, but it could represent, for example, place of residence immediately prior to marriage, or place of settlement under the Poor Laws. Where independent comparative data have been available, it is apparent that through such ambiguities, parish registers underestimate the rate, if not the distance, of migration (Pain and Smith, 1985; Smith and Pain, 1989).

In spite of these caveats, parish registers remain the most complete source of migration data from the sixteenth to the nineteenth centuries, and they have often been used to this end. The usual parameters studied are the proportion of exogamous and endogamous marriages, and the marital migration distance. Studies by Dobson and Roberts (1971), Küchemann *et al.* (1967) and Smith and Purvis (1982), for example, all tend to show that there is an increase in mobility through time, though there are local differences and fluctuations in rates. The important conclusion for this paper however, is not so much that the rates increase through time, as that even in the earliest records migrants are in evidence.

Nor should we conclude that the present-day pattern of mobility, with higher socio-economic groups more inclined to migrate (Smith, M.T., 1984, 1986) is the pattern we see in past centuries, though on a smaller scale. Many of the migrants were betterment migrants moving to the cities, miners, agricultural workers and seafarers moving to new opportunities, and young women going into domestic service. Urban areas were a particular focus of immigration, and the high mortality rates in towns demanded a continual influx of people from the countryside to sustain the population.

For information from earlier than the mid-sixteenth century we have to use sources such as medieval Manor Court Rolls (see Razi, 1980; Raftis, 1974, 1982), Freeman Rolls (McClure, 1979), depositions of witnesses in church courts and apprenticeship records (Clark, 1979), Lay subsidies and Poll Taxes (Campbell, 1990). Migration can often be inferred from records such as these by virtue of the fact that an individual's birthplace is recorded as part of the incidental detail of the document. One drawback of such records as representative sources about migration, is that they may be biased towards the upwardly mobile betterment migrants, for example apprentices, freemen and people chosen as witnesses. Manor Court Rolls are likely to be less selective, and using rolls from the pre-Black Death period, 1278–1348, Raftis enumerated the outsiders at Godmanchester (Huntingdonshire). These came not only from within the county and from the adjacent counties of Cambridgeshire, Bedfordshire and Northamptonshire, but also from Norfolk, Suffolk, Essex, Hertfordshire, Sussex, Buckinghamshire, Oxfordshire, Berkshire, Dorset, Gloucestershire, Leicestershire, Nottinghamshire, Derbyshire, Yorkshire and Lincolnshire.

After the Black Death mobility is known to have increased sharply as lands fell empty for want of local heirs, and the scarcity of labour increased its value and demand. Razi (1980) shows that the proportion of immigrants to Halesowen (Worcestershire) was very considerable, rising from 5% in the 1350s to 18% or 19% in successive decades until the end of the century. A similar picture emerges from Howells's record of the turnover of surnames in the manor of Kibworth Harcourt (Leicestershire). She has documented the persistence of surnames from the late thirteenth century through to the eighteenth, and the most striking aspect of her results is the rapid loss from the mid-fourteenth century onward, through death and emigration, of the core of names present before the Black Death and their replacement by incomers (Howells, 1976).

An alternative and ingenious approach to the study of medieval migration has been adopted by McClure (1979). Surnames in England became hereditary generally in the mid to late fourteenth century, depending on the region. Before this time surnames based on placenames can be taken as indicators of provenance. The evidence is fragmentary, and is biased towards the upper echelons of society, and a large proportion of placenames are not unique. Nevertheless, a rigorous interpretation of the evidence, such as that offered by McClure (1979) seems

to yield a reliable and consistent picture. The feature that seems to me so striking in these data is that the distributions of migrants to towns in the fourteenth century is so thoroughly modern, with the larger towns attracting migrants from further afield, and having a more distant modal value, whereas small towns and rural areas, then as now, have the mode at the origin.

Whilst there is no doubt that the population of the late twentieth century is mobile in greater proportion and over greater distances than its counterpart of four or six hundred years ago, the evidence from England suggests that there was a considerable amount of migration apparent even in the earliest sources. The data from the medieval period seem to show consistently that migration was at least appreciable and in some cases high. It needs to be borne in mind, however, that this early migration might be a particularly "English" tradition, characteristic of a society in which partible inheritance gave way early to primogeniture and where a market in land developed alongside inheritance, partly, but not exclusively as a consequence of the subsistence crises of the fourteenth century (Smith, R.M., 1984).

AGE STRUCTURE

The numbers of old people

My purpose here is to draw attention to some factors which might influence the age structure of archaeological populations. The first, and by far the more important, is a general reflection on the consequence of demographic transition and the recent increase in longevity. Peter Laslett has recently written a stimulating revie of this topic, and the following account relies heavily on his article (Laslett, 1995). The picture which emerges is one where there are in the present day a considerably increased proportion of people over the age of sixty, around 20% compared to less than 10% in the seventeenth and eighteenth century. Extrapolating back into the middle ages, Laslett does not see this proportion further decreasing, and so other things being equal we should expect to see these proportions reflected in the skeletal populations of antiquity and prehistory. It is an odd but accurate reflection that only recently has death become associated principally with old age; in pre-demographic transition populations most deaths are of young people. Laslett makes the further point that a higher proportion of older people is not necessarily a consequence of declining infant and juvenile mortality, but could also be the result of declining birth rate.

Whilst the proportion of elderly persons has increased substantially, the life span itself seems not to have much altered, there always have been very old people, but fewer of them. Laslett finds evidence in support of this contention from the work of genealogists and family historians, who supplied from pedigree studies reliable reports of centenarians dying in the seventeenth and later centuries. The recording of old age is an area, however, where written records have their own bias, with age-rounding and the exaggeration of age being well-documented phenomena. Still more suspect, says Laslett, are the traditional accounts of extreme longevity emanating from South America and the Caucasus. Such claims cannot be substantiated by documentary evidence from registration, and they are often shown to be inaccurate by calibrating the claimant's age against dated historical events.

Age and occupation

Socio-economic status also seems to correlate with life span, and the general trend of evidence is that the higher status populations live longer. This is not universally the case, however, since, as Laslett points out, some high status activities might actually endanger life. Examples include putting babies out to nurse, a practice hazardous to the survival of the baby, and engaging in warfare. As an illustration of this latter social distinction we may cite the case of medieval Welsh society, where the nobility and free men were allowed to fight, but the slave class were not (Charles-Edwards, 1993). As a broad generalisation, however, we should expect between-group variation in longevity to be correlated with social status.

This comment on the longevity of fighting men leads to a rather more general point that occupation might in some circumstances affect expectations of age-structure skeletal populations. One particular context where I have encountered age as a surprising correlate of occupation is during research into the population structure of the parish of Fylingdales in the nineteenth century (Smith *et al.*, 1984). This population included the fishing village of Bay Town or Robin Hood's Bay, and a significant proportion of the working men were fishermen. Tracing this population through the successive censuses of 1841–1891, the mean age of the fisherman increased from 43 to more than 62 years. These improbably elderly fishermen were symptomatic of an industry in decline, with very few young men being recruited to the job. Now sometimes, owing to the hazardous nature of the job, a group of fishermen dies at an instant. The same might apply to miners or quarrymen and so on. Not infrequently, too, men engaged in such occupations may be living together away from their nuclear families. The point I want to draw from this is that occupational distributions may in some circumstances cause skeletal populations to be skewed.

Child abandonment

During the eighteenth and nineteenth century, foundling homes or other institutional arrangements for the abandonment of infants were commonplace throughout southern Europe. The proportion of foundlings among all children baptised reached high proportons in a number of European cities, of the order of 30% to 40% in nineteenth century

Italy. Moreover, although accurate comparisons are difficult to make, the infant mortality rate of foundlings was double or more the rate of other infants.

It is generally reckoned that the foundling hospitals movement of the middle ages was instituted to prevent infanticide. This might have two consequences for the analysis of archaeological populations. Firstly, that we might expect that a proportion of young infants will be missing from conventional burial practice, and secondly, that under certain circumstances these missing children might turn up somewhere else. Boswell (1988) mentions an eleventh century account, in his view not very credible, of Pope Gregory's horror when the heads of more than 6,000 infants were drawn from a fishpond. This sight caused the pope to regret his insistence on clerical continence, the implication being that transgression of the clerical rule of chastity had led to the births of many babies and their subsequent infanticide as a means of covering the evidence. An analogous story of murderous nuns is also given.

Unfortunately one cannot extrapolate directly from the European distribution of foundling homes to the practice of infanticide at an earlier period, since, whilst it is attested that the foundling hospitals arose in medieval Europe in order to deter infanticide, it is not clear whether they were set up only in the areas where infanticide occurred or only where infanticide was thought to be undesirable. Boswell (1988) makes the similar point with his statement that given that Roman law is so explicit about abandonment of children and its regulation, the apparent absence of abandonment in Germanic and Celtic codes, requires some explanation.

INBREEDING, KINSHIP AND INHERITANCE

The significance of inbreeding

Kinship is an organising principal of many societies and, as is well-know to anthropologists, kinship involves relationships negotiated and ascribed by society, which may differ subtly or dramatically from mere blood relationship. For biologists, however, kinship is by definition a measure of biological relationship, and one of the principal areas of its analysis is in the study of inbreeding, the marriage or mating between blood relatives. The significance of inbreeding is twofold. First, it has a pivotal role in the measurement of genetic structure, for which it provides a common currency for comparison of predictions based on population size, migration rates, endogamy rates and pedigrees with assays based on gene frequencies, morphological or skeletal characters. Secondly, there are some very practical outcomes of consanguinity and inbreeding, namely that their consequences might be materially detectable, by affecting either the number, the survival or the condition of the offspring. Such effects might be detectable in skeletal populations, either by the observation of particular recessive genetic disorders, or through levels of relationship inferred from morphological characters, including the so-called epigenetic markers (Härke, 1990) or DNA markers. We can only speculate on the extent to which variations in inbreeding might have occurred in prehistory, but the earliest written sources for Europe and the Mediterranean suggest that extreme rates at both ends of the range may have applied.

From Roman Egypt to Medieval England

We know from the history of the Ptolemies that brother-sister marriage was common in the royal family of Roman Egypt. In this the Ptolemies were not unlike other incestuous royal families, of whom perhaps the best known but by no means the only examples are the Hawaiian and the Inca (Van den Berghe, 1983). It has been argued that royal incest is permitted within the context of strategies for the concentration of wealth by ruling elites in highly stratified societies. Much importance, therefore, is attached to the evidence from surviving censuses of Roman Egypt, that such marriages extended beyond the royal family and were commonplace mong ordinary citizens such as farmers (Hopkins, 1980). Before the practice was suppressed by Roman Law in AD 212 , a surviving census suggests that apparently one in six marriages was between full sibs (Bagnall and Frier, 1994). In Greek law half-sibs could marry (Goody, 1983), and under Roman civil law the marriage between first cousins was allowed.

Christianity rapidly brought about changes to this situation, with increasingly tighter restrictions on the degree and category of kin eligible as marriage partners. Bede's Ecclesiastical History of the English Nation (Bede, c. 737 AD) contains in the recorded or purported dialogue between St Augustine and Pope Gregory, that pope's expected standard of marital and sexual behaviour. He conceded that under Roman civil law cousins might marry, but urged that under church law second cousins were the closest relatives who could do so. St. Augustine's enquiries were intended to provide guidance for the conduct of the English, but similar injunctions were promulgated throughout Gaulish and Germanic Europe. Interestingly, the responses often contain a formula for the dispensation of converts who had contracted prohibited marriages as infidels, suggesting that such marriages were not uncommon throughout the whole region.

The restriction on kin-marriage gradually increased its grip, however, and the prohibitions on marriage between relatives in the eleventh century seem barely credible to a modern eye. At this period, marriages between relatives as distant as sixth cousin were prohibited, on pain of excommunication for transgressors. It is hard to imagine that such prohibitions were scrupulously observed, since it is difficult to see where people would find marriage partners were such a wide network of kin to be excluded from eligibility. When we consider that restrictions were not only applied to blood relatives but also to in-laws and spiritual kin, the task of encountering an eligible partner

can be appreciated. In small populations the options would have been defiance or compliance, either through celibacy or emigration. Goody (1983) sees the church's intention as so increasing the prohibited degrees that people would die unmarried and without issue, and their land, property and wealth would be inherited by the Church. At the Fourth Lateran Council, in 1215, the prohibited degrees were relaxed to comprehend relationships only as remote as third cousin, a shift which perhaps recognised established practice. Such prohibitions remained in force in the Catholic church until the twentieth century, though dispensation to contravene them was widely available and became more common in the eighteenth and especially nineteenth centuries.

In England, for the first few years following Henry VIII's break with Rome (1534–1540), the Faculty Office Registers (Chambers, 1966) record dispensations to marry within the prohibited degrees, that is, up to third cousin. The dispensations show that at least some of the population had an awareness of and concern for relationships both consanguineous, affinal and spiritual (Smith *et al.*, 1992). In fact, by far the largest class of consanguineous marriages dispensed was that concerning third cousins, an excess over expectation on the basis of random mating (Hajnal, 1963). However, the generally low number of dispensations and the fact that there were none at all for first cousins, suggests either that people genuinely were disinclined to marry close relatives, or were indifferent to the stricture upon so doing, or were, perhaps, ignorant of their own more remote kin. On this last point Brundage (1987) is of the view that in medieval times people probably were ignorant of relationships in the fourth degree; his observation is certainly borne out by research from the modern period, where a comparison of pedigree evidence with dispensation requests has shown a shortfall of petitions by remotely related couples (Bourgoin-Vu Tien Khang, 1978). Helmholtz (1974) speaks of the difficulty of finding witnesses in medieval marriage litigation because of the community's ignorance of precise relationships, and the failure of recall in many instances where witnesses were brought to cort. Helmholtz also provides evidence, however, to suggest that consanguineous marriages were not contracted lightly. He quotes directly the words of several individuals who had resisted proposals of marriage on the grounds of the suspicion that they were blood relatives or in-laws of their suitor. He continues with the death-bed plea of a man whose son had married a girl whom he had made pregnant:

> 'I warn and charge you when the opportune time shall come, as you are willing to answer for both of us on the day of judgement, that you do not delay in revealing and making known the consanguinity between my son Robert and Isabel Yonge his wife; for I know in my conscience that they will never flourish or live together in good fortune because of the consanguinity between them'.

These, Helmholtz concludes, are not the words of a man who thought the prohibitions on consanguineous marriage a trifling matter.

Medieval Welsh blood feud

I shall use as an illustration of the importance of kinship and the depth of knowledge of kin the example of rights and obligations in medieval Welsh blood feud. Familial liability in the case of blood feud prevailed elsewhere in Europe, for example under Anglo-Saxon Law, so there was nothing unique in the Welsh system in that respect. I choose it as an illustration here, simply because the information is readily available and the system has been widely commented upon (Charles-Edwards, 1993). As a consequence of homicide, the killer and his family were liable to pay compensation to the family of the victim. The feud and the compensation payment were called *galanus*, and there was an additional concept and payment of *sarhaed*, the insult attendant upon the injury. The payment of *sarhaed* was reckoned among the patrilineal kin up to second cousin (which also seems to have been the kin universe in matters of inheritance of land), whereas *galanus* seems to have been reckoned bilaterally and computed for kin as remote as sixth cousin. The apportionment of responsibility within this group was also precisely calculated. Pierce (1972) writes that the *galanus* was divided into three parts, one part from an inner group of close kin and two parts from an outer group of more distant relatives. Of the first part, ego was responsible for one third, his siblings for another third, and his parents for the other. If we regard the other two parts as together equalling 6/9, then 4/9 was to be derived from the paternal kin, and 2/9 from the maternal. Within this outer group, male relatives paid or received twice as much as female, and relatives in each degree of relationship closer to the murderer or victim had to pay or receive twice as much as those in the next most remote degree.

The precise detail included here does not actually matter, of course. The significance for us is simply that we have clear evidence of a society in which deep ramifications of kinship were recognised and acted upon. It is probable that this sensitivity to kin was reflected more generally in social interaction, and no doubt in settlement. It is likely that kin lived in spatial clusters, and we can speculate that this would be reinforced by partible inheritance, which seems to be the historically antecedent inheritance system in Europe. Inheritance of land-holdings over generations among brothers has led, in the English Lake District, for example, to local clustering of surnames. Such a pattern would have an analogue in any biologically inherited marker, and Y chromosomal markers and mitochondrial DNA markers could give evidence of patrilocal or matrilocal settlement respectively. Regardless of whether one sex rather than the other tended to stay, such a system would be expected to increase between-group variance and increase within-group homogeneity at the level of the local settlement group.

GENETIC DISTRIBUTIONS

The final topic which I should like to offer as an interpretative variable for regional survey is the distribution of genetic traits. There is a very considerable body of informatio about the geographical distribution of genetic traits including comprehensive syntheses by Cavalli-Sforza *et al.* (1994), Mourant *et al.* (1976) and Roychoudhury and Nei (1988). For the most part, the information available concerns blood groups and polymorphic enzymes. Although DNA markers are the focus of intensive medical and empirical research, there is as yet little distributional evidence to match that available for conventional polymorphisms.

The interpretation of gene frequency distributions as markers of historical or pre-historic population structure, depends on a number of assumptions of causation, which I shall try briefly to make explicit. The theory underlying this is called population genetics, the mathematical basis for the understanding of short-term evolutionary change. This theory began to be developed in the early decades of the twentieth century, and was instrumental in convincing a still-sceptical audience of professional biologists, that evolutionary change through modest rates of natural selection was a realistic possibility over the time-scale available.

The association of gene frequency distributions with prehistoric settlement has long been recognised (Fisher and Vaughan, 1939) and extensive use has been made of supposed settlement history in the interpretation of gene frequency distributions (Watkin 1986; Roberts, 1948, 1953; Brown, 1965). However, the models underlying this inference have sometimes been implicit rather than explicit, and the full range of influences upon gene frequency has not been considered.

One very simple way to picture it is this. Imagine that all populations originally had different gene frequencies from each other and that all population gene frequencies remained constant through time. Then when we look at present day gene frequencies we could infer from differences between populations that they were founded by distinctive groups of people. A slightly more complicated model would see all populations with different gene frequencies at the outset, with these frequencies remaining constant unless there was intermixture. If two populations mixed by migration and/or intermarriage, then the gene frequency of the resulting mix would be an average of the two parent populations, weighted by their relative contributions to the admixture. Both these models provide a straightforward historical but non-evolutionary way of interpreting the genetical present in terms of the historical and prehistoric past. The latter model is essentially the one used in an extensive series of papers by Watkin, of which the most recent is cited above, and in a number of other pioneering works of the early blood grouping era.

An evolutionary model, as distinct from a purely historical one, must consider the other microevolutionary processes – in particular natural selection and chance. Natural selection, the differential survival and reproductive success of variants as a consequence of their adaptedness to the environment, has certainly been the focus of interest among evolutionary biologists, but there are other agents of gene frequency change which may over a short time period be of greater effect. On a historical time-scale, migration and chance are much more likely to have an appreciable effect. Change of gene frequencies by chance is usually referred to by the term Random Genetic Drift, which, as a sampling process, is more effective in smaller populations. The special case of gene frequency change as a result of the founding of a new settlement by a small, unrepresentative group split off from a larger population is called Founder Effect. Change of gene frequencies by migration may be the result of large-scale population movements or the movement of individuals. Gene flow is the expression used to indicate the genetic consequences of intermarriage between populations. In attempting to interpret gene frequency patterns in terms of population history, we have to know what sort of patterns of distribution the above mechanisms cause, and models have been devised for predicting the outcome. Although mutation is an important theoretical component of evolutionary change , and undoubtedly of practical importance in he long term, it can reasonably be excluded from consideration here as unlikely to have an effect in this short a term.

In practice, analyses which take account only of migration may indeed lead to a correct interpretation of relationship, because generally migration is a much more powerful force than selection or drift. But drift may be a potent force on small and isolated populations, both obscuring relationships and suggesting spurious correlations through chance convergence. However, the researcher who pursues migration to the exclusion of any other possibility is rather a one-club golfer. And to pursue to the limit the notion that similarity of gene frequencies implies a common origin is to court unlikely conclusions: it's not entirely Watkin's fault that an account in *The Guardian* of his 1986 paper appeared under the headline 'Arabs may have been the first Welsh', but it does demonstrates the risks attendant upon the search for only migration explanations for every set of gene frequencies encountered.

Having expressed this reservation, we can go on to cite cases where a controlled examination of genetic evidence has suggested an inference in terms of settlement. A genetical survey of Cumbrian school children used migration over the last two generations, and the geographical distribution of population, to predict expected genetic relationships (Roberts *et al.*, 1981a). These predictions were fulfilled apart from the area of the English Lake District, which alone had a genetic profile discordant with the predictions. Consideration of present day migration and genetic drift having been taken into account, the way was clear for interpretation in terms of more ancient population settlement. The gene frequencies of this region

are in fact more similar to present day Norwegian genes than to the neighbouring regions (Roberts *et al.*, 1981b). The point I wish to make is this: we should not infer migration on the basis of gene frequency similarities without some independent documentation of the populations' relationship, and we should not exclude other microevolutionary processes from consideration without first assessing their applicability in the situation under review.

There are a number of other examples on a European scale where gene frequency distributions seem to contribute important evidence to the resolution of historical causes. Perhaps the most famous example concerns the spread of agriculture westwards through Europe from its origins in the Fertile Crescent (Ammerman and Cavalli-Sforza, 1984). Whilst the archaeological record of this wave of advance provides us with a chronology, alone it cannot tell us whether it was the idea and practice of agriculture taking hold among existing peoples or a movement of the agriculturalist population from their eastern home to the west. Ammerman and Cavalli-Sforza have put this matter effectively beyond doubt, by showing a cline in gene frequencies, which is consistent with settlement by expansion through natural increase of local populations, as a result of the extra carrying capacity of agricultural subsistence, but which could not be accounted for either by wholesale population movements or by the local adoption of agriculture by indigenous population.

Broadly, spatial patterns which show smooth gradients of frequency are consistent with the "isolation-by-distance" model, and are a consequence not of large-scale movement at a population level, but rather of the general pattern of individual migration distances. Sharp clines or discontinuities in spatial distribution suggest the outcome of population movements, and this contention can be tested by examining the correlates of gene frequency breaks. In this manner, Sokal and his co-workers have consistently found in Europe that whilst there is some correlation with distance *per se*, the principal correlates of gene frequency are physical barriers (mountains or seas), ethno-historical accounts (Sokal, 1991) and linguistic differences (Barbujani, 1991; Barbujani and Sokal, 1990; Sokal *et al.*, 1988). Such analyses have also been performed on the local scale of the British Isles (Bittles and Smith, 1991; Falsetti and Soka, 1993), Italy (Barbujani and Sokal, 1991; Barbujani *et al.*, 1992), and the Iberian Peninsula (Bertranpetit and Cavalli-Sforza, 1991; Calafell and Bertranpetit, 1994), as well as on a global scale (Cavalli-Sforza *et al.*, 1988, 1992). For many years, anthropologists used the archaeologists' migration-hypotheses to explain their own findings on the distribution of genetic traits. This was the case well into the period when archaeologists began to stress regional continuity rather than migration as an explanation of culture change. Ironically, it seems to me now that the single best line of evidence in favour of the prehistoric migration of peoples is the systematic interpretation of gene frequency distributions.

SUMMARY

The areas I have chosen to discuss – migration, age structure, kinship and genetic frequency distributions – are all ones in which there is active and continuing research in biological anthropology and historical demography. What I have tried to outline in this paper is their potential to influence the spatial distribution of artefacts and human remains. Each of them has, I believe, the capacity to furnish directly testable models which can contribute to the interpretation of aspects of the social, demographic and genetic structure of past populations.

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12. Clearing Away the Cobwebs: A Critical Perspective on Historical Sources for Roman Population History

Tim Parkin

Kostas Sbonias, in his impressive and wide-ranging introductory chapter, cites an example from my book on Roman demography, where an ancient literary source appears to give us a relatively sophisticated piece of demographic information, on a particular spot (Alexandria in Egypt) at a particular time (mid third century AD). It is most unusual in two respects: (i) it documents change in population size, rather than just giving a static picture (of the sort 'the population of Alexandria is...' – fairly common in ancient literary and epigraphical sources); and (ii) it gives quite precise quantities, rather than just talking of vague size (of the sort 'there are far fewer people now than there were in the old days' – also quite common, especially in moralizing tracts). Here is the passage in question, a letter from Dionysius, bishop of Alexandria in *c.* AD 262, to another Egyptian bishop, Hierax (Eusebius, *Ecclesiastical History* 7.21.9–10; Parkin, 1992: 63–64):

> Yet men wonder and are at a loss as to the reason for these continuous pestilences, these chronic illnesses, all these kinds of deadly diseases, this varied and vast destruction of mankind; they cannot understand why this very great city of ours no longer bears in it as great a number of inhabitants as before, beginning from infant children right up to the most advanced in age, as it once supported of those whom it called hearty old men. But at that time those aged between 40 and 70 years were so much more numerous that now their number cannot be filled out when all those from 14 to 80 years of age are enrolled and counted together for the public corn dole, and those who appear youngest have become, as it were, the contemporaries of those who in the past were the oldest. And thus, on seeing the human race on the earth constantly diminishing and wasting away, they do not tremble, though their complete obliteration is increasing and advancing.

If one makes some assumptions about the size and structure of the Alexandrian population at this time, and if one assumes that Dionysius is talking about change over a relatively short time, it is possible to convert Dionysius' comments into demographic data and to measure the population decline being described (Table 12.1).

The total number of Alexandrian men aged 14–80 years in *c.* AD 262 is less than the number aged 40–70 years at an earlier date.

- Estimating the population of Alexandria at its height ≈ 500,000;
- and assuming $e_0 = 25$ and that the population is stationary;
- then the proportion aged 40 to 70 years ≈ 25% ≈ 125,000;
- and the proportion aged 14 to 80 years ≈ 66%.
- 125,000 is 66% of approximately 190,000.
- Therefore the population of Alexandria in *c.* AD 262 has fallen from 500,000 to (at most) 190,000, a drop of at least 62%.

Table 12.1. Demographic calculations for Alexandria in c. *AD 262.*

This demographic use of a fairly obscure literary titbit has a rather longer history than I had originally suspected. Edward Gibbon used it in much the same way (and rather more elegantly) more than two hundred years before me in *The History of the Decline and Fall of the Roman Empire* (chapter 10):

> We have the knowledge of a very curious circumstance, of some use perhaps in the melancholy calculation of human calamities. An exact register was kept at Alexandria of all the citizens entitled to receive the distribution of corn. It was found, that the ancient number of those comprised between the ages of forty and seventy, had been equal to the whole sum of claimants, from fourteen to fourscore years of age, who remained alive after the reign of Gallienus. Applying this authentic fact to the most correct tables of mortality, it evidently proves, that above half the people of Alexandria had perished; and could we venture to extend the analogy to the other provinces, we might suspect, that war, pestilence, and famine, had consumed, in a few years, the moiety of the human species.

I cite this example and its use because it is quite instructive in regard to my central argument against the use of historical sources for demographic history. In my book I introduced it not because I believe it to be 'authentic', to use Gibbon's term. It is unlikely that the population of Alexandria did fall from, say, 500,000 to 190,000 over a short time. The massacre in Alexandria carried out by Caracalla in AD 215 is perhaps as close as one might get to the type of decline Dionysius suggests. Cassius Dio (*Epitome* 78.22) states that Caracalla all but wiped out the whole population; the author of the life of Caracalla in the *Historia Augusta* (*Antoninus Caracalla* 6) and Herodian (4.9.4–8) both suggest that his onslaught was particularly directed against males of military age. But even if the events of *c.* AD 262 were just as cataclysmic, I doubt that this passage should be regarded as reliable evidence for such an occurrence. Gibbon makes the assumption that the figures quoted by Dionysius (as quoted by Eusebius) are authentic and exact. Perhaps they are – as I have already said, they are quite unique – but their accuracy or otherwise is only one of many variables to be taken into account. Without knowing how long the corn dole has operated in Alexandria (Jones, 1964: 1045, obviously wrong in dating its introduction as late as the reign of Diocletian; Garnsey, 1988: 254), one cannot measure the chronology of the alleged decline. Is the fall in numbers to be accounted for only by mortality? What of migration, or a change in the eligibility for the dole? (Similar but much more far-reaching problems beset the demographer in analyzing the census data from Roman Italy). Estimates of the population of Alexandria at any time in antiquity are highly speculative (Delia, 1988), and the choice of the 'most correct' model life tables is also open to debate.

Gibbon took the demographic information one step further, by suggesting its application to the wider sphere: not just Alexandria, not just Egypt, but the Roman empire as a whole. From one letter in Alexandria in *c.* AD 262 we have moved to the decline and fall of the Roman empire. This, I would argue, is inappropriate, but in its way it is not uncommon. The application of specific information – specific to time and place – is what is of central relevance to this volume in terms of regional survey. I would not claim to be able to make any significant contribution to the subject of regional survey, but I would like to make some relevant observations about the tempting practice of using often flawed pieces of historical information to create a wider picture. If those pieces of historical information hold any demographic 'validity', it relates to a specific time and place. Generalizing further without adequate bases is dangerous.

One could cite many examples of such a practice, many trivial, some more significant. Ulpian's 'life table' is one example of the latter (Frier, 1982): a legal text, of uncertain purpose, used by modern scholars to recreate the demographic realities of the Roman empire (Tables 12.2 and 12.3). The flaws in the method are many, but not least it needs to be pointed out that data were not collected routinely in ancient times for demographic purposes. The central and mistaken assumption in using anything like the Ulpianic figures for demographic purposes is that they are derived from accurate and precise demographic measurement. They were not; at best they are derived from common sense, vague notions of life expectancy at various ages. There is no empirical basis for the Ulpianic figures: birth and death registration was never compulsory even for Roman citizens, and the census of citizens was only sporadically held. In terms of the provinces, the census was held largely for reasons of taxation, and there is no evidence (quite the contrary) that the data collected were ever used for demographic purposes (Parkin, 1992: 27–40). In regard to the Ulpianic table, we do not even know to whom the figures are supposed to relate.

Aemilius Macer, *On the 5% inheritance law* (*Digest of Roman Law* 35.2.68 pr.):

'For computation to be made in the matter of maintenance (*alimenta*), Ulpian describes the following formula (*forma*): from birth to the 20th year, the amount of 30 years' maintenance will be calculated and the Falcidian portion of this will be due; from 20 years to the 25th year, [the amount of] 28 years [will be due]; from 25 years up to 30 years, 25 years; from 30 years up to 35 years, 22 years; from 35 years up to 40 years, 20 years. From 40 years up to 50 years, the computation will be made by the number of years as are lacking at this age from the 60th year, with one year's remission; then, from the 50th year up to the 55th year, [the amount] of 9 years; from 55 years up to the 60th year, 7 years; and from 60 years, whatever the age, [the amount] of 5 years. Ulpian says that we use this same rule for the computation of a usufruct. However it has been [is?] the practice (*solitum est*) for the computation from birth to the 30th year to be of 30 years, but from 30 years the computation is of as many years as are lacking from the 60th year. Therefore the computation never goes beyond 30 years. Thus, in the same way, if a legacy of a usufruct is made to the state, whether without restriction or for the provision of games, the computation will be of 30 years.'

Summary of the figures:

Age of legatee (x years)	Customary *forma*	Ulpianic *forma*
0–19	30	30
20–24	30	28
25–29	30	25
30–34	60-x (= 30...26)	22
35–39	60-x (= 25...21)	20
40–49	60-x (= 20...11)	60-x-1 (= 19...10)
50–54	60-x (= 10...6)	9
55–59	60-x (= 5...1)	7
60+	0	5

Table 12.2. The Ulpianic 'life table' and its text.

Similar and other arguments can be made against the demographic use of a variety of historical sources, such as tax receipts (Parkin, 1992: 21–27) and skeletal remains (Morris, 1992: 70–102; Parkin, 1992: 41–58; Wood *et al.*, 1992; and various papers in this volume). But I wish to summarize the problems with one particular source that has long been used: Roman tombstone inscriptions. The methods and the difficulties are familiar to many ancient historians (Clauss, 1973; Éry, 1969; Hopkins, 1966–67, 1987; Parkin, 1992: 5–19), but for the benefit of a more archaeological audience and because the range of problems with the tombstone evidence is instructive for

x	q_x	d_x	l_x	$1000m_x$	L_x	T_x	e_x	C_x
0	0.3582	35822	100000	466.9	76716	2110730	21.107	3.63
1	0.2370	15210	64178	70.2	216573	2034014	31.693	10.26
5	0.0641	3140	48968	13.2	236990	1817441	37.115	11.23
10	0.0482	2210	45828	9.9	223615	1580451	34.487	10.59
15	0.0741	3233	43618	15.4	210008	1356836	31.107	9.95
20	0.0827	3338	40385	17.2	193580	1146828	28.397	9.17
25	0.0929	3443	37047	19.5	176628	953248	25.731	8.37
30	0.1056	3549	33604	22.3	159148	776621	23.111	7.54
35	0.1216	3654	30055	25.9	141140	617473	20.545	6.69
40	0.1424	3759	26401	30.7	122608	476333	18.042	5.81
45	0.1707	3865	22642	37.3	103548	353726	15.623	4.91
50	0.2114	3970	18777	47.3	83960	250178	13.324	3.98
55	0.2506	3711	14807	57.3	64758	166218	11.226	3.07
60	0.3278	3637	11096	78.4	46388	101461	9.144	2.20
65	0.4132	3082	7459	104.2	29590	55073	7.383	1.40
70	0.5278	2310	4377	143.4	16110	25483	5.822	0.76
75	0.6754	1396	2067	203.9	6845	9373	4.535	0.32
80	1.0000	671	671	265.4	2528	2528	3.768	0.12

Table 12.3. Frier's life table for the Roman empire (adapted from Frier, 1982).

the hazards of casually using historical sources in general for demographic purposes, it will be useful to review the topic concisely. In sheer size the sample is staggering: some 43,000 ages at death are recorded on the nearly 200,000 epitaphs that have survived from the western half of the empire. It is a tempting equation simply to add up all the ages and divide by 43,000 to determine the average age at death in the Roman world. But the resulting figure has next to nothing to do with real mortality levels in the Roman world; rather the 43,000 ages tell us quite a lot about commemorative practices of the time. Scrutiny of the sample reveals why.

Not all age groups had an equal chance of being commemorated, or of being accorded an inscribed age at death. Usually the very young missed out, while the older had a greater chance. This varied from place to place: in Roman north Africa over 3% of the sample apparently died as centenarians, but remarkably few as children. In fact when analyzed by age groups the sample provides interesting information on diverse commemorative practice but implausible and often impossible demographic rates. The geographical diversity is also striking. If one believed the simple equation, then average ages at death varied dramatically from province to province: in some places they were as low as 14 years, elsewhere as high as 60. Class differences too are important: the sample is heavily biased towards the urban centres, and towards those individuals who had adequate resources to afford a tombstone and a durable inscription. Chronological considerations make 43,000 items of data relatively insignificant. The ages are spread out unevenly over five or six centuries, during which time commemorative practices clearly changed, if not also levels of mortality (Éry, 1969: 62–63; Hopkins, 1987: 119); in effect one is lucky to have one item of data per town or site per generation. One must also question the accuracy of age statements. Not only were some ages obviously exaggerated, but there was a propensity to round up or down to the nearest multiple of five (Duncan-Jones, 1990: 79–92). The letters *PM*, to represent 'plus or minus', even appear next to some ages! The need, desire, or ability to give precise and accurate ages was often absent, it would seem. The sex ratio of the tombstone inscriptions is also remarkable: three males for every two females. But this is no reflection of reality, rather again of commemorative practice – or more fundamentally of the realities of a male-oriented world. The best chance a woman had of being commemorated was if she married young and died in the first few decades of her married life (Hopkins, 1966–67: 260–63; 1987: 125). In short, the information derived from the tombstone inscriptions is only of any use in demographic terms if mortality rates remained constant throughout the period, if migration balanced out, and if the sample is a random selection in terms of age, sex and class. It is highly unlikely that these criteria are even remotely met. What inscriptions do tell us, at best, is about the commemorative practices of a select group at a particular cemetery site, generalized over time.

I would like now to focus briefly on two particular historical sources, both from specific areas and both derived from, or generated in the process of the census: one from the census of Roman citizens in the last year it was held in Italy, the second from the provincial census of which we have by far the most information, that of Roman Egypt, over the course of several centuries.

The first is highly unusual and, as far as I am aware, largely neglected in this context – perhaps with good reason. There are preserved from the Roman census of AD 73/74 details regarding centenarians in the region of northern Italy between the Apennines and the Po (Pliny, *Natural History* 7.49.162–64; Phlegon, *Fragmente der griechischen Historiker* 2.257.37; Beloch, 1886: 45–46, 310; Levison, 1898: 7–8; Mommsen, 1887–88: ii.370; Thomsen, 1947: 114–15). Pliny the Elder, writing in the first century AD on the question of human longevity, summarizes the figures thus:

> Three people at Parma declared themselves as 120 years, at Brixellum one; two people at Parma as 125; one man at Placentia and one woman at Faventia as 130; Lucius Terentius, son of Marcus, of Bononia as 135; and Marcus Aponius 140 and Tertulla 137 at Ariminum. In the hills this side of Placentia is the township of Veleia, in which six declared themselves to be 110 years old, four 120, one (Marcus Mucius Felix, son of Marcus, of the Galerian tribe) 150. And, so as not to delay ourselves any further over a matter of admitted fact, in the census of the eighth region of Italy there were registered 54 persons of 100 years of age, 14 of 110, two of 125, four of 130, the same number of those aged 135 or 137, and three of 140 years.

Pliny asserts that he could ransack all the records to give more figures from the census, but that these figures should suffice to make his point. Lists of *makrobioi*, long-lived individuals (usually important figures from mythology or history), were quite fashionable in ancient times. It is not my purpose here merely to point out the unlikelihood of the figures; that much is patent to most (see also Smith, this volume). But what makes this relatively rare ancient use of census data of unusual interest is that we have another discussion of these data elsewhere.

Phlegon of Tralles, a freedman of Hadrian writing in the second century AD, is not content simply to give summary totals; he insists on naming the centenarians from northern Italy, together with assorted others from Macedonia, Pontus, Bithynia and Lusitania. The comparable data are tabulated in Table 12.4. That Phlegon is not simply following Pliny, but is working from the same original source, is clear. His source of information for the Italian names, he states, is the census lists, which he studied with some care. Phlegon arranges his list in order of decades, that is, those who were 100 years old, from 101 to 110 years, and so on. This may be Phlegon's reworking of the figures as given in the census data, or – perhaps more likely, in view of the fact that Pliny also summarizes the data by age groups – Phlegon's source grouped the figures thus. What is more mysterious is the order of the 46 names in the group of those who are recorded by Phlegon as being exactly 100 years old. They are ordered by first names (*praenomina*): all the Lucii are grouped together, then the Gaii, the Publii, and so on. This is about as sensible as a modern telephone directory ordered by first names rather than surnames. I can see no logic behind such a system of ordering and I find it difficult to imagine that they were ordered thus in the original census lists. It must be the case that Phlegon has rearranged the data available to him, but exactly why he does it as he has is unclear. Perhaps because of his Hellenic background?

At any rate, only one name occurs in both Pliny and Phlegon: Lucius Terentius, son of Marcus, of Bononia, 135 years old. Is it pure coincidence that both authors use

Age	**Number of individuals in**	
in years	**Pliny**	**Phlegon**
100–109	54	63
110–119	14	5
120–129	8	1
130+	12	1
TOTAL	88	70

Table 12.4. Centenarians in the eighth regio *of Italy in AD 73/74.*

census material from the same region? That is unlikely – it may be that Phlegon was influenced by Pliny and followed his lead, or that the centenarians of this region were renowned; I am reluctant to disbelieve both authors and to assume that both copied from another literary source. It can hardly be coincidence that Pliny's only other use of census data also derives from the eighth *regio* of Italy: at *Natural History* 7.48.159, he refers to an individual from Bononia recorded in Claudius' census of AD 47 as being 150 years old. Pliny adds the comment: 'This fact has been verified by comparing the census returns which he had made previously and by the evidence of his life – for the emperor checked this point himself.' It is revealing that Pliny himself, apparently, did not check the figure: could he have done so had he so wished? And perhaps the scholarly Claudius is Pliny's source here? Pliny does not list Claudius as one of his authorities for book seven (though he is cited for several other books and his wife Agrippina is cited for book seven), but does cite him at 7.3.35 ('Claudius Caesar writes that...'). But even if both Pliny and Phlegon were dependent on another literary source for information on the census of AD 73/74, there is still the fact that someone, contemporaneous with Pliny, drew on the census records. Such usage of census material carries with it the ring of authority, and might suggest that my negative conclusions regarding the utility of these figures are too pessimistic.

My point is a general one: the figures from both authors would have the air of genuine authority and authenticity if it were not for two facts: (i) the authors do not agree one with the other (in Phlegon a list of individuals aged between 121 and 130 years is lacking, probably due to a manuscript omission rather than to a lack of alleged survivors at those ages, but even allowing for this omission, Pliny and Phlegon's figures never match up), and (ii) such a high number of centenarians is improbable, to say the least. If Phlegon's detailed list alone had survived, and if the ages stated were of a much lower order, a dismissal of the evidence would be considered ill-founded. As they stand, few would consider these two literary sources, despite their empirical basis, as worthy of serious demographic consideration. One is, however, reminded of the credence accorded by some modern scholars to the extraordinary percentage of very aged individuals recorded on north African tombstones of the Roman period (Parkin, 1992: 7, 163). Figures such as these represent the heightened status which might be accorded to extreme old age, the ancient equivalent of a

Age	Males (%)	Females (%)	Sex ratio
0–9	92 (26.3)	71 (20.9)	129.6
10–19	59 (16.9)	70 (20.6)	84.3
20–29	57 (16.3)	66 (19.5)	86.4
30–39	51 (14.6)	55 (16.2)	92.7
40–49	42 (12.0)	34 (10.0)	123.5
50–59	24 (6.9)	24 (7.1)	100.0
60–69	13 (3.7)	11 (3.2)	118.2
70–79	11 (3.1)	8 (2.4)	137.5
80+	1 (0.3)	–	–
TOTAL	350 (100)	339 (100)	103.2

Table 12.5. The Egyptian census data.

telegram from the Queen. Indeed, exaggeration of age is a feature still found in most censuses – albeit much less pronounced. In demographic terms, perhaps this evidence should warn us about the efficacy of the ancient methods used in the collection of census data, if not also about the accuracy of the resulting totals, such as those that are preserved for the census of Roman citizens in the republic and up to the time of Claudius (Brunt, 1971; Lo Cascio, 1994 and this volume).

Deserving much more substantial respect than the information provided by Pliny and Phlegon are the census data from Roman Egypt. The sands of Egypt have preserved a little over 300 copies of returns made in the census of the Roman imperial era, a provincial exercise carried out every fourteen years (fourteen being the age at which Egyptian males first became liable to the poll tax) over a period of some three centuries. From these returns (or at any rate 233 of them) information of varying quality may be derived on aspects of household structure (declarations being made by house), plus there are preserved the ages of some 1,084 individuals. Table 12.5 summarizes the data for the 889 individuals whose sex and age is known. The sample is far from being a perfect one, unevenly and sparsely spread over time and place as it is. But these data are undoubtedly the best that survive from antiquity in terms of accuracy and randomness, and the recent publication of a detailed and sophisticated demographic analysis (Bagnall and Frier, 1994) has increased their potential usefulness. I have reviewed this work at some length elsewhere (Parkin, 1995); here I wish to present a briefer overview and critique of Bagnall and Frier's work, as it relates to the theme of this chapter, and then I shall conclude with some further reflections on the subject of the wider applicability of such findings.

Compared to the Roman tombstone inscriptions, the number of census returns from Roman Egypt is indeed minute, especially when taking into consideration the geographical and chronological range. Almost 90% of the 'usable' papyri date from between AD 103 and 215. This is not very surprising, since most datable papyri we have, derive from this period. But it means that little allowance can be made for changes over time, significant as these are in demographic terms; no one would argue for a static demographic picture over the course of three centuries (Rathbone, 1990: 114–19). The geographical distribution of the returns is also remarkable. Urban centres are vastly overrepresented; three-quarters of all the returns originate from the Arsinoite and Oxyrhynchite nomes (administrative districts); and, it is worth stressing, not a single return has survived from the great capital, Alexandria. There is no way of quantifying the distortion that such geographical unevenness causes.

Further problems with the database need to be noted. The returns we have are 'private' declarations, not yet checked or corrected by government officials. As with the tombstone inscriptions (though it is to be remembered that with the census returns we are dealing with a living population) the very young are markedly underrepresented. Hence infant mortality rates cannot be calculated. Furthermore, young girls often go unreported, as do young males of around the age when they become liable to the poll tax. The levels of such underreporting, and of misrepresentation of age, appear to have varied beween villages and city centres (*metropoleis*). But, in contrast to the Roman epitaphs and to Pliny and Phlegon's data from the Roman census of AD 73/74 (see above), the ages given in the Egyptian returns are notable for not suffering from age-rounding (with some striking exceptions); of course, precision need not equate with accuracy. Certainly there seems to be deliberate exaggeration of older adult ages, unless the proverbial fertility of Egypt really did produce a whole spate of mothers in their forties and one aged 51! At the other end of the spectrum (211 ages of maternity can be reconstructed from the database) we also find a nine-year old mother. There is something very wrong with the age-spread of the figures, as, for example, a glance at fertility rates reconstructed from the returns shows (Bagnall and Frier, 1994: 143). But this need not surprise. As has already been said, even modern censuses are far from perfect. It is worth noting in that context that to ensure a good degree of demographic reliability it is recommended by the United Nations that censuses be held at least every ten years (Newell, 1988: 15); a fourteen-year gap in Roman Egypt, determined by the requirements of poll tax collection, offers less assurance, especially in view of high infant and childhood mortality. So it might be necessary to assume a not insignificant level of error in age statements, whether intentional or otherwise; inevitably most will now be undetectable, though many may be spotted, even within such a small sample. Another point, already raised, is that most of the extant returns derive from urban centres. One of the significant methodological advances in Bagnall and Frier's analysis is the allowance they make for this bias. By weighting the results towards villages, which would have had at least twice the population of the cities (Bagnall and Frier, 1994: 56) and most probably something approaching four times as many inhabitants (Rathbone, 1990: 123), a more balanced picture may be derived.

With the aid of Coale-Demeny West tables to help make up for such deficiencies in the database, a female life table can be constructed from the Egyptian census

data. The results are highly plausible. Life expectancy at birth of the order of 22.5 years, with a growth rate of a little over 0, is in line with what one expects from comparative evidence. But if the female life table produced inspires confidence, the male figures are less assured (Bagnall and Frier, 1994: 99). This is largely due to the sex ratio in the data, which, when looked at across age groups (see Table 12.5 again), is certainly strange. The difference in sex ratio between villages and *metropoleis* is also striking, with males much more numerous than females in the cities, but females outnumbering males in the villages. With double weighting, the ratio becomes almost balanced, though if one were to argue for a much heavier proportion of the population living in the villages than Bagnall and Frier do (see above), the ratio would be much more in favour of females overall. Male ages are less frequently preserved than female ages in the census documents, and a corrective is needed for that. But how much less frequently? That males outnumbered females in the free Egyptian population is probable but uncertain, and with all the uncertainties and biases present in the census data one is reluctant to base such a conclusion on a relatively small sample. Similarly I am hesitant to accept Bagnall and Frier's hypotheses about the change in sex ratio over time. An ingenious case is developed by them for explaining sex ratio differences over age, and between *metropoleis* and villages, in terms of the migration of young males from the villages to the cities (Bagnall and Frier, 1994: 160–69). This is one explanation, and such migrational drift, for employment or for marriage, is quite credible. But defects in the database are another, more immediate, explanation. Rather than attribute the improbable features of the age-specific sex ratios to inadequacies in the Coale-Demeny models, the problem must lie with the returns as they have survived. Bagnall and Frier argue strongly that the female figures are accurate, the male figures more distorted: males of taxable age are under-reported and older males' ages are exaggerated (males were exempt from the poll tax after the age of 62 years). But older females' ages are also exaggerated. That female ages are systematically distorted too, is possible, but difficult to detect or substantiate.

In terms of fertility (or to be more exact in this context, marital fertility, though it is often difficult to determine exact marital status from the returns), more distortions in the figures emerge, again not unexpected in such a relatively small sample. In the age group of those in their early twenties the percentage of married women drops sharply and unexpectedly. Males are marrying earlier (in the early twenties on average) than appears to have been the norm in the western empire (Saller, 1987). It is a great pity that the sample is too small to allow a close analysis of changes over time in marriage patterns, or for that matter between *metropoleis* and villages. But it is evident that in many cases there was a substantial age gap between marriage partners: young women were marrying older men. As has already been mentioned, a fascinating scenario is developed by Bagnall and Frier to explain this, whereby young men, finding it difficult to acquire a wife, migrate to the *metropoleis* (but was the situation any different there?). One option, closer to home, was to marry your sister – one of the most remarkable aspects (to us) of Graeco-Roman Egyptian culture. It is also striking that men were more likely to remarry than women. It would appear that older women were generally not remarrying after the death of a spouse or after divorce, and that this factor acted as a control on population growth. The complexities of the remarriage scene, by the way, with spouses bringing in children from previous marriages, and in some cases divorced couples still living together, even with new marriage partners in the house, complements and supplements the picture recently developed of complex family groupings in the urban West (Bradley, 1991).

So the Egyptian census data offer a great deal. But about whom? Can we, as Gibbon was keen to do with Dionysius' letter to Hierax, apply evidence from one locality to a broader sphere? At one level it might be argued that the results from the census data relate only to two of the more than thirty Egyptian nomes, since it is from two Middle Egyptian nomes that the vast majority of the returns derive. And indeed the demography of Middle Egypt may have been quite different in certain respects to the rest of Egypt – for example in levels of urbanization, and in the practice of close-kin marriage. Or can the results be held to be good for Egypt as a whole? Or can we go even further and assert that they in fact relate to the Roman empire at large? It is extremely tempting to take this final, bold step, and in certain respects it is viable. Roman Egypt would not have differed markedly in many demographic features from the rest of the empire (Saller, 1994: 66–69). Average life expectancy at birth, for example, would probably have been at a fairly consistent level, with some regional and temporal variations, as well as some differences over social class. That almost all people, male and female, married at some point in their lives, and usually at a relatively young age, would also be generally true. Such demographic features are relative constants, with little variation over the pre-modern Mediterranean world.

But regional differences, cultural and otherwise, are important, as I have stressed already. That the demographic picture derived from the Egyptian census evidence relates to the Roman world as a whole is possible but unproven. It is not that I deny the wider applicability, only that it cannot be assumed. To uncover the demographic realities of the entire Roman empire, with a population at its height of roughly 60 million (Beloch, 1886: 507; Parkin, 1992: 5, 162) and covering a vast and diverse geographical area, seems to me a heavy burden to place on 300 census returns (or 233 with data on ages) from select parts of Roman Egypt over the course of several centuries, with data imperfectly preserved and distorted by various biases.

Furthermore, the level of urbanization in Egypt was higher than in almost any other part of the Roman world,

and so one would expect marked demographic differences in some features from other less urbanized provinces; indeed the census returns back up this assertion. As has been noted, males in the census returns appear on average to be marrying earlier than their western counterparts. Adoption does not figure at all in the census returns, but we are increasingly becoming aware of its importance as a feature of the Roman family. This all brings us to questions of social bias. It has usually been held, most notably by Keith Hopkins (1980), that the census returns, for all their imperfections, are representative of the Egyptian population as a whole. But quite apart from geographical problems already noted (the Arsinoite and Oxyrhynchite nomes predominate, the *metropoleis* are overly represented, and Alexandria does not feature at all), it is also possible that the returns that are extant have survived precisely because they were produced by a slightly more affluent group of people than the average (Hobson, 1985; Hopkins, 1980: 315–16). Particularly important in this regard, though largely overlooked by Bagnall and Frier, is Brent Shaw's article (1992) on a related subject. It is Shaw's broad contention in relation to the census returns that they do not represent the Egyptian population as a whole at all, but rather in the main a select group within that population, namely the direct descendants of Greek settlers. This may be overstating the case, but in any event the comment that '[i]n the census returns, chances are better than one in two that if a 15-year-old woman marries, her spouse will be either her sibling or a much older man' (Bagnall and Frier, 1994: 133) strikes me as far from typical of the Roman empire as a whole.

In summary my argument regarding the demographic utility of historical sources is a rather sceptical one, but all is not lost. Most historical sources on the age and sex structure of the Roman population are of little demographic value. The fact that it is the only evidence we have, is no justification for using it regardless of the problems. The most compelling evidence is the census returns from Roman Egypt, which, somewhat fortuitously, allow the development of plausible demographic models (in conjunction with model life tables) but which cannot be assumed to have wider applicability. The census data serve to reinforce our assumptions about some demographic variables of the ancient world, in that the data do not contradict those assumptions. Modern demographic models provide the best indication of what is possible or plausible in terms of ancient population patterns in general.

Site surveys have a longer history than many might suspect. When the notorious emperor Elagabalus felt like playing a joke on his slaves, he sent them off around the city of Rome to collect a thousand pounds of cobwebs; they returned with ten thousand pounds of the stuff. Elagabalus deduced from this that Rome was indeed a big place (*Scriptores Historiae Augustae: Antoninus Elagabalus* 26.6). Fortunately methods – and results – have improved. If regional surveys provide us with new insights into the demography of the ancient world, particularly in regard to changes over the long term, then that is something to be welcomed warmly. And judging by papers in this volume, as well as other recent work (especially Alcock, 1993), they clearly do provide such insights. One point I would like to stress, although in the case of those engaged in regional site survey I am clearly preaching to the converted, is the potential danger of applying such findings outside the region being considered. But more to the point I would stress that the future is positive. The intricate and complex web of demographic variables that made up the ancient world is increasingly being revealed, and interdisciplinary approaches, such as those advocated in this volume, are clearly the way forward.

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13. The Population of Roman Italy in Town and Country

Elio Lo Cascio

The aims of this paper are threefold: 1) to present briefly the most significant and secure data on the size of the population of Roman Italy, that we can confidently draw from certain literary and epigraphic sources referring to the beginning of the Empire; 2) to give an evaluation of the ratio between urban and rural population in the most urbanized area of the Roman Empire, at the height of its urbanization (see e.g. Bekker-Nielsen, 1989), that seems to be suggested by these data themselves, by a clever exploitation of some epigraphic evidence (Duncan Jones, 1974, 1982[2]: ch. 6) and by the physical remains of some towns; 3) to detect what the dynamics of the Italian population in the last two centuries of the Republic could have been, by looking at two important sets of numerical data that appear in our written sources. The fields covered will be therefore those singled out by K. Sbonias (this volume), as the ones in which regional surveys could provide potentially valuable data in reconstructing past population: data on the density of population, deduced from density and pattern of settlement, which are thought to allow even an estimate of an absolute figure of population for a specific area (and not only a calculation of its carrying capacity); data on the rural-urban split of the population; and data which can allow the detection of demographic trends and the explanation of population change. In this last field it is true that only survey evidence can offer information to supplement and to test the data that it is possible to draw from the literary sources: even if funerary inscriptions, Egyptian census records and skeletal evidence can be thought to provide information on age and sex distribution of a population, therefore on its structure, they can hardly be of any use in trying to assess its dynamics.

It seems to me that the major contribution offered by surveys in reconstructing the population of Roman Italy, is the possibility they give not only to test the plausibility of the literary and epigraphic evidence on the census figures and in general on the figures for population that we find in our sources, but also to choose among conflicting interpretations of this unique evidence. Moreover they seem to represent the only device we have in trying to discover the different regional patterns of population density, synchronically and diachronically (a partial exception will be illustrated below). Of course, the choice between conflicting interpretations of the evidence on the size of population, turns out to be a choice between conflicting reconstructions of the economic and social history of the peninsula, as we will see.

On the other hand, since the factors which can affect the density of settlements are many and sundry, and since the size of population is just one of them, the contribution of the written sources is essential in confirming the absolute figures drawn from a survey. Of course, there is the risk of circular reasoning, if the interpretation of the written sources is controversial. But this risk must be run.

THE POPULATION OF ITALY AT THE BEGINNING OF THE EMPIRE: THE AUGUSTAN CENSUS FIGURES

I will start from the estimate of the population of Italy at the beginning of the empire. It is well known that the *Res gestae* of Augustus have transmitted the results of the censuses of the citizen body (most of whom were located in Italy), held in 28 and 8 BC, and in AD 14: the figures for the *civium capita* which were counted are respectively 4,063,000, 4,233,000 and 4,937,000 (a different figure for this last census was transmitted by the *Fasti Ostienses*; the reasons for preferring the figure of the *Res gestae* do not need to detain us here: see Nicolet, 1991). Furthermore Tacitus in his *Annales* gives the result of the census held by the Emperor Claudius in AD 47, as 5,984,072 *civium capita* (again, different figures are given by Eusebius and Jerome, but the tradition of Tacitus is more convincing). Now, the problem which these numerical data present is well known: does the expression of *civium capita* refer to the whole citizen population or just to a part of it, the adult males? The expression of *civium capita* does not appear for the first time in the Augustan age. We possess, in fact, mostly in Livy and the annalistic tradition and in the

chronographic tradition, a whole set of figures indicating the results of the republican censuses, and these also are referred to by what looks like an official formula: 'censa sunt *civium capita* tot' (for a complete list of the figures and an almost complete list of the sources for them see e.g., Toynbee, 1965, I: 438 ff.). Nobody has doubted that these figures, on the whole, are reliable and significant (or at least the figures referring to the censuses from the late third century onwards), whatever confidence one can have in some of the individual figures as such. It is also plainly attested that these figures refer to the adult males (or even to some specific categories of adult males). But the problem is that even the figure referring to 70/69 BC, that is, the one of the last Republican census, when the whole of the population of the Italian peninsula (with the exclusion of Northern Italy) was made of Roman citizens, is of a different order of magnitude, in comparison with the figures of the three Augustan censuses: it is less than 1/4 of the figure for 28 (910,000, according to Phlegon, FGrHist 257, fr. 12, 6; 900,000, according to Livy's *Per.* XCVIII).

How the leap between the figure for 70/69 and the figure for 28 must be interpreted has always been a problem. Beloch thought it impossible to account for the enormous increase in the number of *civium capita*, unless one made the assumption that the criteria and the aims of counting the *civium capita*, and consequently the notion itself of *civium capita*, had been changed. He was convinced that it was impossible to explain the leap as no more than a consequence of the extension of the citizenship to Transpadana, of colonization and of a natural increase of population; in the troubled last decades of the Republic such an increase must be considered extremely unlikely. He therefore put forward the hypothesis that, whereas the Republican figures refer to adult males, the Augustan ones refer to the whole citizen population, including women and children. According to Beloch, the citizen population of Italy, in 28 BC, could not have been, therefore, more than 3,250,000 (Beloch, 1886: ch. VIII).

Beloch's solution has been endorsed by most subsequent scholars, notably by Peter Brunt in his *Italian Manpower* (Brunt, 1971, 1987^2: ch. IX). However, other historians like Tenney Frank and Hugo Jones (in his Inaugural Lecture, at the University of London) adopted a different solution (Frank, 1924; Jones, 1948). Both Frank and Jones pointed to a strong underregistration in the Republican censuses, and especially in the last one, as the key element in explaining the different order of magnitude of the Republican census figures in comparison with the Augustan ones, even if they differed slightly over the relative importance of various possible reasons for this underregistration. Frank insisted more on a conscious policy of the Roman ruling class aimed at 'keeping the new citizens from gaining a preponderating influence in Roman affairs' and on the 'lack of interest shown by the Italians in the franchise', or at least in participation in political life at Rome. Jones insisted on the practical difficulties of census-taking at Rome, at least till the introduction, by Caesar, of a new decentralised procedure, involving the towns' governments (as evidenced by the *Tabula Heracleensis*, *FIRA* I^2. 13, ll. 142 ff., on which see Lo Cascio, 1990: 308 ff.). Beyond the increase in the number of *registered* people, Frank considered also an actual increase of the citizen population to be plausible, notwithstanding the heavy toll taken on the population of the Italian peninsula by the civil wars; this increase would have been the result of a high rate of manumissions, of the enfranchisement of a thickly populated area, like Transpadana, and of massive veteran settlements in the provinces. If the four million *civium capita* were just the adult males, the whole free population of Italy in 28 BC could not have been less than, say, ten-twelve million.

Frank's and Jones' solution seems to be much better founded (Lo Cascio, 1994, a and b). It must be stressed that there is not a shred of evidence in favour of the idea that women and children could be counted in the census, and the idea itself is absolutely implausible: the preservation of the traditional character of the census in the Augustan period seems to be confirmed by the continued association, which is actually stressed in the account of the *Res gestae*, of census with the *lustrum*, the ceremony of purification of the whole citizen body constituted as an army, which used to close the operation of numbering the citizens; and this association would be meaningless, if women and children had been included in the total of *civium capita*. Moreover, one can invoke positive evidence for the identification of *civium capita* as adult males in the Greek version of Eusebius' *Chronicon* preserved in Georgius Syncellus, which expressly refers the figure of AD 14 to the *andres*; the word *andres* is used also by the Suda, with reference to the same census.

But there is more. Beloch thought it necessary to suppose that the Augustan census figures referred to the whole citizen population, because otherwise, according to him, it would have been impossible to explain the leap between the figure for 70/69 BC and the figure for 28 BC: in other terms the basis of his far-reaching hypothesis was a simple argument from likelihood. In fact, it is possible to show that Beloch's solution, far from being the only plausible solution, is not at all plausible. It obliges us to accept that between 70/69 and 28 the original population was decreasing at a very rapid pace and that the number of the people made citizens (and not born citizens), like the enfranchised in Northern Italy and in the provinces, or the freedmen, was very low. Since most of the 430 cities in Italy were flourishing during this period and urban population and in particular the population of Rome was enormously increasing, to suppose that the original citizen population was decreasing at a rapid pace means to hypothesise that the rural free population of the peninsula was in fact collapsing (I am not convinced by the attempt by Morley (1996), ch. 2, to see migration to Rome as the main cause of this supposed collapse: see Lo Cascio, forthcoming, b, and c). Moreover, the average free population figure for the 430 Italian towns cannot be posited at

less than, say, 1,000: but even so low an estimate as 430,000 for the whole free urban population in Italy, except Rome, would be extremely high, in comparison with the total population, if the order of magnitude of this total population was around 3,250,000, as Beloch thought. According to the guestimates of Hopkins, based on Beloch's and Brunt's interpretation of the Augustan census figures, there would have been 2,900,000 free persons in the countryside, 600,000 in Rome, which was fed in part by the provinces, and 500,000 in the 430 towns (Hopkins, 1978: 68–69, table 1.2). Now, the proportion of urban dwellers is much too high for a preindustrial scenario, as Hopkins himself is obliged to admit. E. Boserup has shown that a significant urbanization of a particular territory is impossible, unless it is accompanied by the sustained growth of the rural population (Boserup, 1981: ch. 6). Therefore, it is an inescapable conclusion that the collapsing free population in the countryside must have been replaced by a huge number of slaves.

In order to accept Beloch's solution, one has to assume, therefore, not only that between 70/69 and 28 there was a collapse of the free population in the countryside, but also that the additions to the citizen body represented by the extension of citizenship and by manumissions were not substantial, and furthermore that a big slave population in the countryside in the whole of the peninsula had replaced the free peasants, and that the total population of the Italian towns in the Augustan age was very small.

The alternative solution is to suppose that the Augustan census figures represent, like the Republican ones, the adult males and that the leap is the product of new criteria in census taking, which brought about a much more efficient registration. It seems to me that this solution is confirmed by the analysis of the procedures of the census adopted during the Republic. The census was the periodical assessment of the citizen body: it was the operation by which Roman citizens were registered and counted. Its purposes were military, fiscal and political: in a timocratic state like Rome, the census served to identify who were obliged to serve and to pay tax and who had political rights. Whatever the original aim of census taking, by the third century these three functions of the census were co-existent. Census was taken every five years through declarations (*professiones*) of the heads of families, who had full juridical capacity (the *sui iuris*). The *sui iuris* declared all the persons of his family who were under his *potestas* (his wife, if she was not *in potestate* of her father, his children, the children of their children) and his properties, including slaves, for which he had to give an evaluation in monetary terms. The Roman government was therefore potentially able to enumerate all free persons of both sexes and every age, and even the slaves, because all of them, free and slaves, were registered. But it is absolutely certain that not all the persons registered were in fact numbered. Then the problem is to establish who were the numbered people, the *civium capita* for which we have a long series of figures. The only category which is excluded by definition from *civium capita* is slaves. As for the others, many different theories have been advanced on the identity of the *civium capita*. Some thought that initially *civium capita* included all free persons of citizen status, but only adult males from the fourth century onwards. Others maintained that adult males were enumerated. Still others supposed that *civium capita* were just one specific category of adult males: a) the *iuniores*, that is, the adult males from 17 to 46 (the ones who were obliged to serve in the army), with the exclusion of the *seniores* (the adult males from 46 to 60); b) the *sui iuris*, that is, the people who made the *professiones*, with the exclusion of the *filii familias* (the men who had a living father or grandfather); c) the *assidui*, that is, the men who were obliged to serve, since they were the citizens included in the five *classes* in which the Roman citizen body was divided: that would mean that the census figures did not include the *proletarii* or *capite censi*, too poor to be admitted to the *classes* and therefore exempted from military service (except in emergencies), and the freedmen, who did not serve in the legions; d) the *iuniores assidui*, the only citizens potentially subject, by age and by census qualification, to conscription.

Obviously, I cannot discuss these various views here, but I should like to present in a very schematic way the most significant results of the analysis I conducted elsewhere (see Lo Cascio, forthcoming, a: ch. 2).

1) The identity of the *civium capita* was not precisely the same throughout the whole of Republican history, even if the military purpose of the enumeration was always the main though not exclusive purpose of it. It follows that the connection between *census* and *lustrum*, originally the ceremony of purification of the army marshalled in the Campus Martius, never vanished.
2) The identity of the *civium capita* and the way in which they were enumerated depended on the way in which the registration of the citizens was effected, and on the way in which the list of the citizens was built in the various stages of Republican history. In a first stage *civium capita* must have been those who materially served in the army; in a second stage, those who were capable to serve in the army, that is, the *iuniores assidui*; finally, all the adult males who were included in the *classes* and the centuries: during this phase, the list must have been built by *classes* and centuries, and it is therefore reasonable to think that just the adult males who were included in the *classes* were included also among the *civium capita*.
3) After the dissolution of the Latin League and the reconstruction on a new basis of the Roman state, the list was no longer formed by *classes* and centuries, but by tribes (the territorial districts into which the *ager Romanus* was divided): the tribes became something more than territorial districts, they became the new subdivision of the citizen body. Now, even *proletarii* must have been included among the *civium capita*, in so far as they were registered (the *capite censi*), and

even freedmen. *Cives sine suffragio* (the inhabitants of certain communities, like Caere, who were Roman citizens, but did not vote in the *comitia*, and were not eligible as magistrates) were no longer included, since they were outside the tribes. These citizens were registered apart, and in the list of them must have been included also the citizens who were deprived of the right to vote. This new system of building the list of *civium capita* was connected with a reform of the way in which the levy was conducted (it was no longer based on the *classes*, but on the tribes) and of the way in which the *tributum* was assessed.

4) At the end of the Republic, with Caesar, registration by tribes was abandoned and a new criterion was adopted: the *sui iuris* no longer had to come to Rome to make his declaration before the censor or the latter's deputies; he made his registration before the highest magistrate of his *municipium* (or *colonia*, or *praefectura*), according to the system which is described in a section of the *Tabula Heracleensis*. Correspondingly, the list was no longer by tribe, but by community. Roman citizens domiciled in Rome were declared by the *domini* of the *insulae* in which they lived, according to the procedure described by Suetonius (*Div. Iul.* 41. 3; Lo Cascio, 1990, and 1997a). The fact that the *sui iuris* was no longer obliged to come to Rome increased enormously the efficiency of census taking. And that can explain, along with other reasons, why the number of *civium capita* in 28 was more than four times the number of Roman citizens in 70/69. It follows that it is possible to estimate at 13,500,000 the number of Roman citizens of both sexes and every age in 28. Of these, perhaps some 12,250,000 were in Italy. The figures for A.D 14 are respectively 16,400,000 and 14,470,000 (Lo Cascio, 1994b). As we shall see, no more than 600–700,000 Roman citizens were domiciled in Rome itself.

To put the free population of Italy in 28 at twelve million instead of three – four has its own merits. The higher estimate appears more consistent with what we know about the economic conditions of Italy at the height of her imperialistic expansion. The higher estimate of free persons allows to give a much more conservative estimate of the number of slaves and a much more credible ratio between free and unfree. Finally the higher estimate allows us to put the ratio between urban and rural population at a much more credible level and it is much more consistent with what we know, by independent evidence, of the size of the population of some urban centres which can be taken to be typical of the Roman towns in Italy.

THE RURAL / URBAN SPLIT

If the proposition about the numerical ratio between free and unfree is in itself unverifiable, the conclusion on the ratio between urban dwellers and total population seems to be consistent with the figures for urban population outside Rome which it is possible to draw from other evidence: namely the epigraphical one, exploited by Duncan-Jones (1974, 1982^2: ch.6), and the archaeological one represented by the extension of the walled area of a number of ancient towns in Italy (see Beloch, 1898).

But before analysing briefly the data themselves, we must underline that the rural/urban split does not correspond, in fact, to the split between population engaged in agriculture and population engaged in non-agricultural activities. We must take into account two phenomena: the first is the so-called 'agro-towns', which, according to some scholars, could have been the norm especially in Central Italy, where the concentration of urban centres was such as to allow for a substantial part of the agricultural population day-commuting from the town to the fields (Bekker-Nielsen, 1989: 30); the other is the artificial foundations, common after the Social War, especially in Appennine Italy: small urban centres with just some public buildings and a sparse population in the countryside around. The agro-towns were nucleated settlements, with a city status; the artificial foundation was the meeting place for a non-nucleated settlement, or for several nucleated settlements which did not possess city status. There are reasons to think, however, that the former phenomenon was not actually widespread (see Garnsey, 1979); and it is on the whole probable that just the smallest among the urban centres of the Italian peninsula could have been agro-towns and artificial foundations. (What Cicero observes about Capua in *de lege agr.* II 88 – that the Romans did not want to destroy the city of Capua when they reconquered it in 212 BC, after she had deserted to Hannibal, since the *urbs* could serve not only as the supplier of what was necessary to the cultivation of the fields and as the place in which to assemble and store the agricultural products, but also could provide the *urbis domicilia* for the *aratores* – does not imply, in my view, that the majority of the population of Capua, one of the biggest towns in Italy, with an area of 180 ha, was engaged in agricultural production. Cicero wants to say that the Romans did not maintain the autonomous institutions of Capua as a city, but reduced it to the status of just a nucleated settlement in a confiscated agricultural region; see also Garnsey, 1979: 9).

Moreover, we have to consider another phenomenon which points in the opposite direction: a substantial proportion of rural population was not engaged in agricultural activities or was engaged in them part-time. This must have obtained especially in those areas, like Central Italy in the late Republic, where rural monetization was more widespread and the degree of division of labour was higher (see de Ligt, 1990). Now, comparative evidence seems to show that in preindustrial societies 'the percentage of non-agricultural activities exceeded the proportional weighting of the urban population by 4 to 5 percentage points' (Bairoch, 1989: 266). If this was also so in Roman Italy, if the whole urban population was less than the whole

non-agricultural population, we cannot put the level of the urban population at more than, say, 15–20% of the total population (Bairoch, 1989: 247, based on towns larger than 2,000; incidentally, it is only by supposing that Boeotian towns were in fact predominantly agricultural that it is possible to accept the whole recent reconstruction of the population of Boeotia given by Bintliff (1997), as also resumêd by Sbonias (this volume). Of the 11,500,000–13,500,000 free inhabitants of Italy, outside Rome, then, no more than 2,300,000–2,700,000 lived in the ca. 430 towns of Italy, with an average of 5–6,000 per town. Is this a credible average?

From the mainly epigraphical evidence concerning large-scale gifts for feasts and distributions, Duncan-Jones was able to infer some conservative estimates of the free population (in general of the urban centre) of ten Italian towns (Spoletium, Comum, Pisaurum, Sentinum, Corfinium, Petelia, Rudiae, Fabrateria Vetus, Saturnia). Most of these towns, which we know were very small, had a free population between 1,000 and 2,000. But Sentinum, which was by no means a big centre, had no less than 2,725 and no more than 5,550, Pisaurum no less than 9,800 and no more than 18,550, Comum no less than 14,700 and no more than 17,500, and Spoletium 17,850 (probably in the urban area). It is apparent that figures like these cannot easily be reconciled with the assumption that the free population of the Italian towns except Rome was in the region of 500,000, as Hopkins estimated it (Hopkins, 1978: 68 ff., tab. 1.2), but they do seem consistent with the assumption that the free population of the Italian towns except Rome was in the region of 2,300,000–2,700,000: Comum and Spoletium were not among the biggest urban centres of Italy.

The attempt of Beloch to deduce mechanically the population of the Italian towns from the extension of the walled area (and using the Pompeian evidence) is certainly not convincing. But again the figures for the area of the Italian towns he quotes (e.g. Larinum 165 ha; Capua 180 ha; Caere 120 ha; Volsinii 80 ha; Neapolis 70–100 ha; Pompeii 64,7 ha; Patavium more than 85 ha; Bononia 80 ha; as a comparison, it is worth noticing that the area of Rome inside the Servian wall was 430 ha, and inside the Aurelian wall was 1,373 ha, whereas the maximum extension of the inhabited space has been estimated at about 1,800 ha: Homo, 1951, 1971[2], ital. transl.: 81), seem to be much more consistent with the high estimate of the total urban free population of Italy, than with the low one.

The same conclusion can be drawn from the cases of Ostia and Pompeii, which are obviously the best documented. I do not want to rehearse here the discussions about the possible estimates of the population of the two cities which can be inferred from the physical remains. I agree whole-heartedly with what Andrew Wallace-Hadrill has recently written on this subject (Wallace-Hadrill, 1994: 95 ff.), by pointing out that every attempt to deduce mechanically a figure for population from the extension of the inhabited space is doomed to failure, since we do not know what the population density could have been and it is impossible to try to extrapolate this datum by comparative evidence, and since the idea itself of a constant population density is obviously wrong. But certainly, as the analysis of Wallace-Hadrill himself shows, the Pompeian evidence could be exploited not by using an average density of the inhabited space to calculate the total population, but by looking at the individual houses themselves and by trying to calculate the number of the people who were presumably living in them, as Fiorelli had already done and as other scholars, most notably Eschebach, have done subsequently (references in Wallace-Hadrill, 1994). Even so, there remain uncertainties: on the one hand, we do not know how many of the houses in Pompeii had upper storeys; on the other hand, we *do* know that part of the area within the walls was not built (or at least that it was not rebuilt after the earthquake of AD 62); and in general it must be assumed that the level of population, at Pompeii as elsewhere, changed over time. What we can confidently get, then, is a range of values for the whole period of the life of the town, between a minimum and a maximum (and therefore also a minimum and a maximum of density): we can take the estimate by Eschebach, of 8,000, as the minimum, the estimate by Nissen, of 20,000, as the maximum (and the discussion by Wallace-Hadrill convinces me that the higher estimates are more credible on general terms; different conclusions in Storey, 1997a, and b). The resulting densities per ha would be 120–300. The same values for Ostia are remarkably higher, and this is understandable, given the prevalence of the *insula*-type buildings in Ostia, at least from Trajan onwards: the estimate by Calza is 36,000, by Meiggs between 50,000 and 60,000, by Packer no more than 27,000 (Meiggs, 1960, 1973[2]: 532–4, 597–8, and references there): the corresponding densities would be, respectively, 521, 725–870 and 391 per ha. The adoption of this higher range of densities, in the case of the towns for which we can establish the extension of the walled area, would mean that there would have been in Italy many urban centres with a population of over 20,000: and again this seems to confirm the high estimate of the total urban population. But even by adopting the 'Pompeian' range of densities, the number of towns with more than 10,000 would be so substantial as to rule out the low estimate of the total urban population.

Finally, there is the case of Rome. I cannot review the enormous literature that has grown up on this issue: suffice it to say that scholars have attempted to draw estimates of the total population of Rome from many snippets of information in the literary and epigraphic sources on the number of beneficiaries of *frumentationes* and *congiaria*, or on the total consumption of grain, or on the numbers of houses and blocks of apartments, transmitted by the so-called Regionaries of the fourth century AD. We can confidently say that this evidence, for all the uncertainties and for all the controversies about the interpretation of the individual sources, constitutes by far the best we have on the population of an ancient city. What I can do here is just

to summarize the conclusions which I arrived at in my recent treatment of the whole issue (Lo Cascio, 1997a; see also Lo Cascio, forthcoming, b; I cannot discuss here the much lower estimates given by Storey, 1997a, and b, which implicitly discard the ancient evidence). We have uncontroversial figures for the number of beneficiaries of corn distributions during the Caesarian period and the Augustan period; a much more debatable datum from a very late scholium at Lucan apparently preserves the figure of the total consumption of grain, when Pompey was charged with the *cura annonae*. Now, it seems possible to infer from these data that the citizen population of Rome reached its maximum level of 700–800,000 before the measure, taken by Caesar, to reduce the number of beneficiaries (adult males) of grain from 320,000 to 150,000. The population of Rome decreased after that measure (but of course not proportionally to the decrease of the number of beneficiaries), but began to increase again during the triumviral period and the Augustan age. In 2 BC Augustus 'closed' the number of beneficiaries of public grain (adult males from 17) at 200,000: that corresponds to a total citizen population of more or less 600,000 (to which we have to add foreigners and slaves: but it is impossible even to guess their number). This citizen population does not seem to have increased substantially during the first two centuries of the empire. It must have been a bit less in the Severan age and presumably during the third century, to increase again during the fourth, when we have figures for the consumption and the distribution of *caro porcina*, which seem to converge with the higher estimate that is possible to draw from the data on the number of *insulae* we find in the Regionaries. The total population of Rome in the fourth century was not very short of 800,000. The collapse came with the sack of Alaric, at the beginning of the fifth century.

The size of the population of imperial Rome, abnormal by pre-industrial standards, was a direct product of a very careful organization of food supply, most of which came from the provinces. In this sense any estimate of the ratio between agricultural and non agricultural population in Italy must necessarily leave Rome out of consideration.

THE POPULATION OF ITALY IN 225 AND THE TREND OF THE POPULATION BETWEEN 225 AND 28 BC

Coming back to the population of Italy, I propose now to enlarge the scope of the analysis by looking at a previous stage of her history, the third century BC. My aim here is not only to try to evaluate the population of the Peninsula, or, better, of her central areas, two centuries before the Augustan age and to discover the regional differentiation; it is also to evaluate the dynamics of the free population of Italy in the last two centuries of the Republic, by a comparison of the data of the third century with the datum of 28 BC. My questions will be, then: did the free population of Italy increase, or decrease, or remain stationary during the last two centuries of the Republic, when Rome acquired her Mediterranean Empire? What interpretation of the written sources can be taken to be more consistent with the survey data?

My starting point is two kinds of evidence: on the one hand, the census figures, on the other hand a very famous passage in Polybius, about the events of 225 BC (Pol. II 23–24), which contains a numerical account of the military strength of the Romans and their allies on the eve of the Gallic invasion of the peninsula: a passage which has been used to evaluate the population of Italy since the controversy between Robert Wallace and David Hume in the eighteenth century, on the populousness of the ancient nations compared to the modern ones (Lo Cascio, 1993–4). Polybius' account is certainly derived from Fabius Pictor, the first annalist, who was, according to Orosius, an eye-witness of the events; and the information given by other sources (like Diodorus, Pliny and the Livian tradition in Eutropius and Orosius himself) must come directly or indirectly from Fabius. The reason why Polybius includes in his narrative of the Gallic invasion a whole account of the numerical strength of the Romans and their allies is clearly stated: he wants to show how bold Hannibal was with a small army in deciding to invade the Italian peninsula, which could reckon on an impressive manpower. Therefore he states the numbers of the various forces on which Rome can rely, listing them according to an order perfectly logical in the light of what the Roman strategy of defense will be. First of all, Polybius reports the numbers of the Romans and the allies under arms: the men who served in the two consular armies (one stationed in Sardinia, the other near Ariminum), then the men who served in the emergency armies raised in the regions facing the invasion, evidently levied after the normal dilectus had already taken place. The army of Etruscans and Sabines, under the command of a praetor, is sent to Etruria; the army of Umbrians and Sarsinates is sent to reach Veneti and Cenomani (who lived beyond the border of the Roman territory): they will operate a diverting manoeuvre in the enemy's territory. Polybius concludes this section by observing: "These were the armies protecting the Roman territory". Following this list of men under arms and ready to combat, Polybius mentions the reserve at Rome and gives its numerical strength, and then he refers to the *katagraphai* (the documents giving the number of men of military age) sent by the communities of Central and Southern Italy, with the exclusion of the Bruttians (the people of modern Calabria) and the Greeks, and with the exclusion, obviously, of the communities among which the emergency levy had already been conducted. He indicates, then, the strength of the two legions stationed in Sicily and at Tarentum (summoned evidently beforehand and by regular levy) and the total number of Romans and Campanians on the rolls, a number which ought to correspond, in its meaning, to the one declared by the allied communities in their *katagraphai*. Finally, Polybius gives the total number of the forces summoned to defend Rome or "stationed before Rome"

(more than 150,000 foot and 6,000 horse) and the total number of the men "able to bear arms" (more than 700,000 foot and more or less 70,000 horse). The first of these two totals has raised problems, since it does not seem to be equal to any of the possible "sums" of the single items mentioned by Polybius. Most commentators have regarded it as a gloss; others have tried to understand it in one way or another, but the sum of the cavalry, on any calculation, cannot be right. In the second total it has been easy to discover the general total of the forces enumerated by Polybius; a general total which cannot be precise, since some of the entries are not precise either, according to Polybius himself, but which is built, as required by the logic of the situation and as expressly stated by Polybius, by summing up *all* the various items mentioned.

The Polybian passage seems absolutely clear and his second total perfectly consistent with the presentation of the Roman strategy given by Polybius himself; his listing of the forces presupposes the various stages of this strategy: after the normal levy had been conducted, there was a supplementary levy (a *tumultus*) in the areas of Central Italy facing the invasion (Etruria, Umbria, Sabina), and the request of the *katagraphai* to the allied peoples, who were not summoned through the emergency levy, and perhaps the assembling of the reserve at Rome. That is, there is a distinction between men under arms and men not yet summoned, whose numbers appear in the *katagraphai* and in the total of Romans and Campanians. The obvious conclusion is that, according to Fabius-Polybius, the total of the Roman and allied forces is correctly made up by the total of men under arms plus the total of the forces mentioned in the *katagraphai*; these *katagraphai,* like the figure of Romans and Campanians which appears at the end of the list, do not refer to the total of the men on the registers before the normal levy and the emergency levy had taken place, that is, including the men under arms; but they refer to the total of the men on the registers once the normal levy and the emergency levy had already taken place: that is, when the various armies mentioned by Polybius had already been stationed.

This conclusion, which seems to me absolutely necessary, if we trust Polybius, was the conclusion of Mommsen (Mommsen, 1876). But it was subjected to a radical criticism by Beloch and by most of the scholars who have dealt with this problem, particularly Afzelius, Walbank, Toynbee and Brunt (Brunt, 1971, 1987[2]: ch. IV, and ref. there; and now Baronowski, 1993, but see Marchetti, 1978: 141 ff.). According to Beloch, Fabius would have made a crass error: by adding up all the forces that Rome could oppose to the invaders (her forces, the Etruscans and the Samnites, the Umbrians and Sarsinates), he would have calculated the Romans and the allies under arms twice: the actual total of the Romans, including the men already under arms, would be the figure that Polybius gives at the very end of the list, as the figure of the Romans and Campanians: 250,000 foot and 23,000 horse; and the single totals for every group of the allied communities, including the men already under arms, would be the ones indicated in the *katagraphai*, a figure representing the total number of iuniores available in these communities. Moreover, the total of the Etruscans and Sabines and the total of the Umbrians and Sarsinates would be precisely the figures given by these same peoples in their *katagraphai* and not the number of the men actually under arms. What Fabius had at his disposal would have been just the *katagraphai* and he would have derived the figures from these *katagraphai*; it would have been impossible for him to know the numbers of the men of every group of communities under arms, in order to subtract them from the *katagraphai*.

The fundamental reason why Beloch thought that the Polybian figures must be intended in this way, is that only in this way can we consider the figure of the *cives Romani* given by Polybius to be in line with the census figure for 234/3 (or for 239/8) known from the Livian *periocha* and interpreted as representing all the adult males. Once one admits that Fabius must have taken his total for Romans and Campanians from the last census figure (that is, from the unknown figure for 230/29), one has to conclude that the figure given by Fabius cannot be much higher than the figure of the *periocha* for 234/3 (or for 239/8). Now this figure is 270,212 *civium capita*. If we assume that the *civium capita* were 325,300 (that is, the Romans under arms plus the Romans and Campanians on the registers), the increase over the figure for 234/3 (or for 239/8) would be hardly credible as the result of a natural increase of population; therefore, it seemed more economical to think that a gross mistake was made by Fabius in calculating the Romans under arms twice. If the total of *civium capita* in 225 was just 273,000, the increase would be very reasonable: just three thousand.

There are, however, obvious shortcomings in the theory of Beloch, which I cannot dwell on (see Lo Cascio, forthcoming, a: ch. 3). Moreover, if one does not admit a crass error by Polybius, which is undemonstrable and implausible, one has to suppose that the Polybian figure for Romans and Campanians cannot have been calculated on the same basis as the figure for *civium capita* for 234/3. The flaw in Beloch's theory is to suppose that the apparent similarity between the figure of the *periocha* and the figure given by Polybius for the Romans and Campanians would show that both the figures were in *pari materia.* But nothing could be more debatable. The census figures, during the third century, comprised all the registered adult males in the tribes, including the *seniores*, and excluded therefore probably, as we have seen, the *cives sine suffragio*. Moreover, the proportion of *proletarii* who registered themselves must have been low; the very fact that the penalties for failing to register were the same as the penalties for those who failed to present themselves at the levy, seems to suggest that the primary purpose of the obligation to register was to avoid evasion from military service. Since *proletarii* were not individually called to serve in the army and were recruited in very rare emergen-

cies *en masse*, there would have been no point in insisting on their registration.

The expressions that Polybius used and that were derived by Fabius himself seem to imply that the figures he gives are representative of the total mobilization of the *iuniores* (Lo Cascio, 1991/94: 324 ff.). The *katagraphai* required of the *socii* were to exhibit the number *ton en tais elikiais*, that is, of 'those in the ages', the men of military age. This expression obviously translates the Latin *iuniores*. Dionysius of Halikarnassos uses the expression *oi echontes ten strateusimon elikian* ('those who have the military age') for conveying the same concept (see e.g. IV 15. 6; 16.1; V 45.8; VIII 17.2 etc.). The total number (*sympan plethos*) of the men that Rome can oppose to the invaders is the total number *ton dynamenon opla bastazein*, 'of the men able to bear arms'. The expression translates the Latin one 'eorum qui arma ferre possent', used by Livy evidently to refer to the physical fitness to combat that depended on age (Livy III 4. 10; cf. I 44. 2; in this same sense the expression is used by Caesar in the *Bellum Gallicum*, with reference to the Gallic armed forces: I 29. 2). Moreover, the Polybian passage seems to suggest that the emergency levy was conducted (for the first time?) regionally. And that is the reason why we get totals for each geographical or ethnic entity, and irrespective of the distinction between citizens and allies. The procedure of the regional levy must have been adopted not only in the conscription and gathering of the allied forces, but of the Roman forces as well: and that is the reason why we have a total of Romans and Campanians, or of Etruscans and Sabines, citizens and allies. (So, it is on the whole probable that the "Latins" did not include the inhabitants of Beneventum and Canusium, but of the Latin towns in Latium vetus and in Latium adiectum, and that the Samnites did not include the inhabitants of Southern Campania.)

If the Polybian figures are conceived as maximum figures of men able to bear arms, that is, of *iuniores*, it is possible to estimate the number of adult males in the territory of the Italic confederation and in the various areas of it, and the total free population of these areas. Assuming that the *seniores* are more or less 25% of all adult males, and that the adult males are more or less 30% of the total population (both credible proportions in view of the age distribution in a stationary model population comparable to the Italian one, and of the probable sex-ratio: Lo Cascio, 1994 a), it is possible to calculate the total number of the adult males at more or less 1,000,000 and the total population at a bit less than 3,500,000. It must be stressed that these are very conservative estimates, since there must have been strong underregistration, even if we have no possibility whatsoever to calculate its rate (the estimate by Brunt of 10% underregistration for the Roman citizens, and 20% for the allies is as good an estimate as any other: Brunt, 1971, 1987[2]: 54, table V). That underregistration must have been massive is shown by the very small number of the Latin *iuniores*, in view of what we know about the number of the colonists sent to the individual Latin colonies (as Brunt has observed). However, even so small a number of Latin *iuniores* is very high when put in comparison with the number of *iuniores* not only of the other allied communities, but also of the whole *ager Romanus*; and that means that underregistration must also have been very high for the Roman citizens.

With the proviso that the figures must be on the very low side, it is possible to calculate the density of the free population in the whole area of the Italian Confederation (less the territory of the Bruttians and of the Greek communities of Southern Italy), as 32–33 per square km. Moreover, we do have the possibility to get a rough idea of the density of population in the different areas of peninsular Italy: the results which can be derived from Polybius, without amending his text, are shown in Table 13.1. In building the table, I took from Afzelius the data referring to the areas of the ethnic entities mentioned by Polybius, without considering the possibility that the figures which Fabius had at his disposal might have referred to geographical entities not entirely corresponding to the ethnic ones (that is, without considering the possibility that Beneventum was not included among the 'Latins', but among the 'Samnites'). And I made just two simplifying assumptions: the first is that the army of Etruscans and Sabines was formed by 2/5 Roman citizens and 3/5 allies; the second is that, among the men under arms, the percentage of the individual contingents of the different ethnic units was the same as the proportion of their residual manpower as revealed by the *katagraphai*: in other words, I assumed that, if the Lucanians, according to their *katagraphai*, were less than half of the Samnites, the Lucanians already serving in the army must have been less than half of the Samnites already serving. (For the sake of simplicity, I did not take into account the distinction between foot and horse.) As for other communities apparently not mentioned in the Polybian list (like the Hernican or the Volscan), I followed Afzelius and Brunt in considering them associated with the neighbouring peoples mentioned by Polybius. Finally, given the uncertainty about the army of Sabines (all of them citizens) and Etruscans (some of them citizens), I thought it impossible to calculate an autonomous density for Etruria, and so I summed up the area of the *ager Romanus* to the area of the Etruscan communities, and the population of the *ager Romanus* to the population of Etruria. Of course, that means that I underestimated the density of population of the *ager Romanus* proper and overestimated the population of Etruria. In fact, if we do not take into account the Roman citizens in the emergency army of Etruscans and Sabines, we get a density, for the whole ager Romanus, of 56 persons per square km.; it seems to me an inescapable conclusion that we do not have, in the case of the army of the Sabines and the Etruscans, a figure which is strictly comparable with the figure of the *katagraphai*, requested of the other peoples, as most modern commentators have maintained, but precisely the strength of the emergency army, as Polybius

	Iuniores	Adult males	All free persons
Romans + Etruscans,	385,300	514,000	1,713,000
Latins,	101,000	135,000	450,000
Samnites,	91,500	122,000	407,000
Apulians,	78,500	105,000	350,000
Abruzzi peoples,	29,000	39,000	130,000
Umbrians,	24,000	32,000	107,000
Lucanians	39,000	52,000	173,000

	Territory (in sq. Kms.)	Numbers per sq. Km. (All free p.)
Romans+ Etruscans,	44,700	38,3
Latins,	10,630	42,3
Samnites,	10,330	39,4
Apulians,	17,085	20,5
Abruzzi peoples	7,410	17,5
Umbrians,	7,235	14,8
Lucanians	10,400	16,6

Table 13.1. Free inhabitants of Italy in 225 BC.

says. And that means in turn that the figure for the population of Etruria which it is possible to derive from the Polybian passage is probably much too low.

Be that as it may, we must ask whether the density of population of Central and Southern Italy in 225 BC which we draw from Polybius is a credible one. Afzelius thought it convenient to compare the data for 225 (as calculated by him) with the density of agricultural population as revealed by the Italian census of 1936 (Afzelius, 1942: 98 ff.). However he did not make a detailed comparison for the *ager Romanus*, but only for the allied peoples except the Latins, the reason for that being the difficulty of comparing a territory like the *ager Romanus* or, even worse, the territory of the Latin communities, with the territory of the modern administrative districts – the provinces – in Central and Southern Italy. Afzelius compared, for instance, the figure for the Samnites with the figure relating to the modern provinces of Napoli, Benevento, Avellino and Campobasso; the figure for the Lucanians to the figures relating to the modern provinces of Salerno, Matera and Potenza. The choice of this method may sound, at first sight, correct and reasonable, since it is based on the assumption that in antiquity most of the active people were engaged in agriculture. His results, again, may seem on the whole plausible: the ancient population, as calculated by him, is constantly about 60–75% of the modern agricultural population for each district of Italy (the estimates of Afzelius are not very far from my own estimates). Now it is precisely this result which sounds suspect: we would be induced to postulate a continuity in land use over two thousand years. Moreover, if we take the modern agricultural population of the provinces of Central Italy which were not taken into account by Afzelius, that is, the provinces more or less corresponding to the *ager Romanus* and the Latin territory in 225 BC, we reach an apparently paradoxical result: the density of population, as calculated by Afzelius (following Beloch), would be slightly more than the density of agricultural population in 1936. But there are other obvious shortcomings in the method adopted by Afzelius: he considers, for example, among the modern population to be compared with the Samnites, the agricultural population of the province of Naples; but in 1936 the province of Naples included the Terra di Lavoro, that is, the Campanian plain, and that means that he has overestimated the modern population thought to correspond to the Samnites. But the most serious difficulty with this sort of comparison is that the modern agricultural population in 1936 is not the most reasonable term of comparison. Modern agricultural population does not include, of course, the population of the big urban centres; and it is a reasonable assumption that, since agriculture in 1936 was, even in Italy, more efficient than in antiquity, less people were able to produce more food. On the other hand, if we take the total modern population as revealed by the census, say, of 1871, as the term of comparison, there will be other factors of distortion: the huge population of modern Naples, for example, in 1871 almost doubled the density of Campania. Also in 225 BC there were, indeed, conspicuous urban centres: we cannot do more than suggest a very rough estimate of the population of Rome, for example. But it is interesting to observe that, according to Afzelius' calculations, there is no more room for the population of Rome itself, than 100,000 people (a very low estimate, even for Rome of the late third century).

It seems to me, therefore, that comparisons with contemporary population patterns can be misleading more often than not, and that they can give only the most generic indication of the plausibility of our estimates. It is far more useful to look at the estimates made by several people, first of all by Beloch himself, in his *Bevölkerungsgeschichte Italiens* (Beloch, 1937, 1939, 1961), for late-medieval and early-modern Italy. Now the total population of the Italian peninsula was in the region of 9–10 million in the XIV century and of 12–13 million in the XVII century. The density of population in 1340 (that is, immediately before the outbreak of the Black Death) is estimated by Cipolla at 34 per sq. km., but it was 85 in Tuscany. At the middle of the XVI century the density was at 100 in Liguria (Cipolla, 1965; 1975[2], 201 ff.). By the XIV century Italy was highly urbanised, but there was perhaps no urban centre with a population comparable with the population that Rome can have attained by the end of the third century (150,000, according to Hopkins, 1978: 68 f, tab. 1.2). We can say, then, that a population of 1,700,000 for the *ager Romanus* plus the Etruscan communities in 225 BC is on the whole absolutely reasonable in terms of the carrying capacity of the land.

But this is a conclusion of modest importance. Far more significant is to decide whether the Polybian data on the population of Italy in 225 BC are more in line with the orthodox view on the meaning of the Augustan census figures, or with the view that they represent just the adult

males, and, in the end, whether the free population of Italy declined severely in the last two centuries of the Republic or increased. Now, Beloch's estimate of the whole free population of Italy in 28 BC is about 3,250,000, with a density of 12 per sq. km. Frank's estimate of the whole free population of Italy in 28 is about 10,000,000, that is, a density of 39 per sq. km.; my own estimate is higher, 12,250,000, with a density of 47 per sq. km. Assuming that Beloch is right, even if we suppose, for example, that Cisalpina had a much lower density than Central Italy, we must necessarily conclude that the Italian peninsula experienced a dramatic decrease of the free population, which must have reduced it to less than half the level obtained in the third century. If we accept the higher estimates, we can consider the whole free population of Italy in the last two centuries BC more or less stationary, or we can posit a rate of increase perfectly reasonable in societies before the "demographic transition"; all depends on the estimates of the population of Northern Italy in 225 and in 28 BC.

It is precisely in order to choose between these two conflicting interpretations of the written sources that survey data can be decisive. Do survey data suggest a marked decline of the population in the whole of the Italian peninsula? It seems to me that, except for specific areas like the Biferno valley, they suggest on the whole an increase in the density of settlements (Lo Cascio, 1994b). On the other hand, the big increase of population in Cisalpina, which survey data confirm, is the direct product of a tremendous wave of immigration from Central and Southern Italy: but do we really think that such a wave can be explained if the free population of Central Italy was markedly declining? I am not sure that the thorough transformations of the agrarian economy of Central Italy must have been necessarily disruptive for subsistence farmers; but even if we admit they were, emigration to Northern Italy, besides migration to Rome and to the other towns of the Italian peninsula, must have been the obvious response. Admittedly, an increase in the density of rural population could be the consequence of the tremendous influx of slaves and not of an increase of free men. But many of the slaves were manumitted, and even if we have no possibility of even guessing what the rate of manumission could have been, we must assume that their number was substantial, given the huge number of imported slaves, and given the proportion of freedmen in the Italian towns as revealed by tombstones for a later period (and taking into account the possible distortions imputable to the so-called "epigraphic habit"). Even if the native stock was declining and even if the freedmen were not able to reproduce themselves, the spread of the practice of manumission must have contributed in every generation to the increase of the citizen body, or at least it must have filled the gap, if the native stock was declining.

It seems to me, in conclusion, that it is impossible to prove a marked decline, or even a decline of the free population of Italy in the last two centuries of the Republic, according to what purports to be the orthodox view, which found Brunt and Hopkins among its main supporters in the English speaking world. I would say, instead, that the comparison between the Polybian figures for 225 BC and the Augustan census figures can be interpreted as showing a modest, reasonable increase of the free population of Italy. The order of magnitude of this increase could have been such as to imply the doubling of the population in about two centuries, with an annual increase well below 0.5%. Now it seems to me unquestionable that a population increase is more consistent than a population collapse with what we know about the economic conditions of Italy during the period in which Rome acquired an empire. The expansion of the so-called 'slave mode of production' meant a sustained economic growth, whose evidence is the increasing importance of Italian exports. There was no disappearance of the Italian peasantry, as is becoming now clearer and clearer, since Italian peasants were structurally necessary to the 'villa-system'. Moreover, an increase of the free population of Italy is more consistent with what we know about the progress of urbanization of the peninsula.

One can ask whether the level of population in 225 and in 28, which we have posited, can be judged reasonable in the light of the subsequent history of population of the Italian peninsula. A population of 12–14 million at the beginning of the Principate compares perhaps as well as a population of 4–7 million with what we can reasonably guess was the population of Italy in early modern times. It must be pointed out that, even if for shorter periods an increase of the order of 0.3%-0.4% per year is quite plausible for premodern populations (before the so-called 'demographic transition'), a normal rate of increase, in the long run, could not exceed 0.1–0.2% per year (see e.g. Livi Bacci, 1987: ch.I). That means that a population can double respectively in 700–350 years. It would be, then, perfectly plausible to suppose that, at that rate, a population of, say, 4–6 million in the first century of our era could reach the level of 10–12 million by the XIV century. It must be observed, however, that the decrease of population in Europe in the decades following the first outbreak of the Black Death has been estimated at the very high level of 30–40%, and it took centuries to recover such a loss. Now, I have argued elsewhere that the Italian population went on to increase during the first two centuries of the Empire and that by the second century there are clear signs of overpopulation (Lo Cascio, 1994b). The outbreak of the Antonine plague must have reduced the population substantially, and its recovery must have been checked by the outbreaks of the middle of the third century. A further probable increase during the fourth century must have come to a halt and the trend reversed during the fifth and sixth century, when the Graeco-Gothic War and above all the plague again must have reduced drastically the population of the peninsula (see Lo Cascio, 1997b). The epidemics of the sixth century represented probably the first appearance in Europe of the plague, and its effects must have been largely comparable to the effects of the Black

Death, at least in some Mediterranean areas. And in fact a very severe decrease of the population of Italy by the end of the sixth century is a very common notion, which seems to receive support from the data of surveys. Now, the lower we put the population of Italy in the seventh or eighth century, the higher we have to posit the yearly rate of increase in the centuries between the seventh or eighth centuries and the fourteenth. If we put the figure at two million, in order to attain the ten or twelve million of the fourteenth, we have to suppose that the rate of increase during the intervening centuries must have been much higher than 0.1%. It seems to me, therefore, that not only it is not intrinsically implausible that the level of population reached in the Early Empire by the Italian peninsula had not been attained yet by the Later Middle Ages, but that in fact this is the most plausible assumption.

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14. Documentary Sources for the History of Medieval Settlements in Tuscany

*Maria Ginatempo and Andrea Giorgi**

INTRODUCTION

It frequently happens, at least in Italy and at least as far as concerns the medieval period, that historians and archaeologists (by the former we mean simply those who study the past through documentary sources and by the latter those who study it through material sources) tend to overvalue each other. More than occasionally it happens that one or the other, disenchanted about how far he may go with his own sources, ransacks the sources of the other – in an exaggerated spirit of optimism – for the answers he cannot find, thereby distorting them, failing to understand their representativity and above all rendering more difficult and opaque the dialogue between the two different ways of investigating the past. The dialogue itself, in reality, has generally been conducted at the level of contents and the attempts at integration have often been resolved by the pure and simple juxtaposition of results. Dialogue at the level of methods (or rather, on the terrain of the potentialities and limits peculiar to the sources of the specific competence of one or the other), however, would not appear to have been greatly developed yet, apart from a few exceptions (Delogu, 1994a; Wickham, 1994; Francovich and Wickham, 1994), or more crudely, dialogue about what we know or what we can reasonably expect to know from a certain type of source and about what – on the other hand – we do not know and will probably never know.

What we would like to do here is give a contribution in that direction, drawing a picture of what may be recovered from the documentary sources available for Tuscany, for the purposes of a history of its medieval settlements. This is a region of Italy which emerges in more than one phase as being particularly privileged with regard to recorded history, as well as in studies – both recent and not so recent, – which permit the acquisition of precise knowledge of what can be done with historical data and of the limits beyond which one cannot reasonably go. The intention is above all to delineate the lacunae and the areas of irremediable indecipherability, as well as the areas and themes for which it is impossible or counterproductive to look for comparisons or reciprocal interpretative confirmations between the two kinds of source. We are therefore seeking to isolate, on the one hand, areas within which it is possible simply to juxtapose information drawn from different kinds of source, in the hope that they will stand up in their own right (through internal comparisons, for example, or because analysis of the record-bearing structures, written or material, have enabled us to understand the causes and meanings of the silences themselves, and so on). And on the other hand, we wish to identify the areas and arguments in which one may hope to make profitable comparisons between documentary sources and archaeological sources, testing reciprocally their verisimilitude, formulating new questions and so on. A clear picture of the potentialities and the lacunae typical of each type of source seems anyway the indispensable premiss to any possibility of dialogue.

That is all the truer if one thinks that both the information drawn from archaeological sources and that stemming from documentary evidence are distributed with great unevenness in space (across the Tuscan region) and above all in time (throughout the ten centuries of the medieval period). For the sixth-seventh centuries little or nothing is available from written sources (and the scraps of information that there are concern mainly the frontier zones between Lombard territories and Byzantine dominions); on the other hand, much more, proportionately, is becoming available from material sources. For the eighth-tenth centuries there is somewhat more documentary evidence, but the information remains limited, of difficult interpretation, and concentrated only in some quite restricted areas (in the northwest of the diocese of Lucca, plus something in those of Pisa, Volterra and Pistoia; and in the-south-east in the orbit of the great Benedictine monastery of San Salvatore at Monte Amiata); while hardly anything can be had from the archaeological sources, because of the very scarce visibility and datability of the material traces from these centuries. With the eleventh-twelfth century period things improve dramatically for both types of source: both

written documentation and material evidence for the territory increase rapidly and become in addition more clearly legible: through the opening of new channels of production and conservation of documents on the one hand (a series of 'minor' monasteries, the cathedral chapters, and towards the end also the city communes) – and on the other, through the generalised diffusion of the use of stone in buildings (it is the period of the castles, as well as of the romanesque *pievi* and other churches or, at all events, of a higher profile material culture). Great difficulty remains however (because the successive phases of development still obscure much of this), many lacunae and many gaps remain where the comparison between the two types of source is not possible, although the integration of the two orders of evidence becomes progressively more productive because the silences begin to 'speak'. In some areas, for instance, (in the south of the region in particular) the written documentation remains decidedly scarce, owing to the presence of much stronger and unchallenged power-structures (what is handed down from the eighth-thirteenth centuries is linked above all to the existence of controversies, conflicts between various kinds of elite, contradictions concerning power itself and intense social mobility), but about such structures and the forms of settlements tightly connected to them, one begins to find information from progressively richer and more numerous archaeological sources (Delogu, 1994a; Wickham, 1994; Francovich and Wickham, 1994).

From the thirteenth century, finally, the written documentation experiences an increase which is, to say the least, exponential, firstly quantitative, then also qualitative (with radical typological transformation in the documents produced in the ambit of the city-state and then in that of the regional states), while the information from archaeological-material sources although itself growing richer (the thirteenth/ fourteenth century phases are generally much clearer than the preceding ones), increases to a lesser extent. This multiplies enormously the possibilities of dialogue and comparison, but has three effects which are not altogether positive.

1) It tends to shift the dialogue itself towards particular sectors (especially for the period 1300–1400).
2) It can translate into a certain imbalance, and historiographically it has done and to a great degree continues to do so, with the sole exception of the fields of study opened up by the excavations of cemeteries (Ginatempo, 1988a)[1], or rather, perhaps, into a sort of misguided 'inferiority complex' on the part of archaeology, both in the sense that recourse to material sources may appear progressively less useful and necessary, and in the sense that archaeology itself is gradually tempted to utilise models produced from written sources, rather than constructing its own for later comparison.
3) It creates a situation, finally, in which both archaeologists and historians tend to pounce on the first well-illuminated moments in their sources (those in which the dialogue is at last productive), with the principal intention of reasoning retrospectively. That holds true especially for the thirteenth century, which in general gets associated with the problematic horizon of the preceding centuries, as the point of arrival of a series of dynamics originating from around the tenth century. On the basis of the new richness of information there is a tendency to formulate hypotheses about the preceding centuries, to elaborate models or interpretative schemes to be applied *ex postfacto*, or to select one's questions with the 'wisdom' of hindsight, falling sometimes into errors of perspective or of thoroughgoing misdating.

It must be said however that the picture briefly sketched so far, as well as the more detailed one that will follow, is to be considered substantially definitive, as regards the written sources for the sixth-seventh century period and the eighth-ninth (there are no reasonable hopes of discovering other sources, nor of filling lacunae, but perhaps only of diminishing a little the interpretative paradoxes by sharpening the instruments of exegesis), and in large part also as regards the eleventh-twelfth centuries (a period whose potentialities and limits appear clear, even though unpublished and only partially-registered documentation begins to come to light in gradually increasing quantity). This picture is already less complete though from the mid-twelfth century (because the unedited documentation is prevalent, the documentary typologies much more varied and the instruments of access much less adequate), and it is not at all complete for the archaeological sources, in any of the periods taken into consideration. The written sources up until the twelfth century are in fact so few in proportion as to be by now all known and in large part exploited (in publications, cullings, erudite indexes, and, of course, in bibliographies). From the thirteenth century, the documentary panorama may still reserve some surprises (particularly as regards sources of ungovernable dimensions or those still lacking valid exponents like notaries and judiciaries, or as regards sources preserved in ecclesiastical or private archives that remain virtually inaccessible), but the broad and extensive excavations conducted by a now consolidated tradition of studies permit it to be said that the principal sources have almost all been discovered and sounded, and that generally-speaking we are not then so very far from the virgin rock. There is still much to be done – let it be clear – but it is little in comparison with what there is still to do, in a panorama of potentially unlimited archaeologico-material resources that have only been subjected to sustained exploitation in Italy over the last twenty years or so. If the picture outlined for the documentary sources by now reflects – or is very close to doing so – the structures of recorded history and, roughly, how much one can hope to do with it, the archaeological sources provide a picture that reflects, above all, the current state of the discipline

and its principal difficulties. We are beginning to understand nevertheless the trends in the processes whereby recorded history is handed down through written texts and through the visibility and legibility of the material traces, which, apart from the odd divergence relative essentially to the centuries of transition to the medieval period (that is the sixth-seventh centuries), run from then almost parallel towards us, as well as the possibility of dialogue between the two types of source. The difference is that for the interpretation of the material traces (over and above their quantitative multiplication) we can hope for strong developments that may re-illuminate the most hidden and misty periods; while for the written ones we are already arriving at the exploration of their limits, or at least at the point where we can begin to imagine where future studies will have to stop.

We will consider just two of the questions raised by Kostas Sbonias in his introductory paper: that of the definition of site, and that concerning the relationship between settlement trends and population trends – or the network, the forms and the density of the settlements on the one hand, and the levels of population (those reducible to the relation inhabitants/square kilometer) on the other. The two questions are closely connected, but it is necessary to consider the first immediately, as a way-in to the problem, and the second at the end, as a conclusion and summary of our reasoning.

Archaeologists must define and classify a site on the basis of pottery remains, or, where there is more substantial evidence, on the basis of the configuration of habitation and activity suggested by that evidence. Historians must do so, as if it needs saying, by analysing not things but words, through the exegesis of terms used in relation to the names of places. They must, to put it another way, operate upon a series of internal comparisons, in order to draw out the semantic value with which each term is used in varying contexts, and construct a glossary in which terms and places are referred to a concrete reality, habitational forms, economic, political and social functions, and so on. A collateral operation (and closely dove-tailing with it) is that of localising toponyms according to lines of toponomastic tradition that have come down to us or are in some way retrievable. Preliminary to all this, just as the definition of the site is preceded by the location of material traces, is the question of clarifying just which sites will be useful for the purposes of a history of settlements and population, and under what categories they should be classified.

We employ a basic distinction in using the terms *site* (sito) and *settlement* (insediamento) to mean, respectively, those places that serve no habitational function (like isolated churches, farming or 'industrial' infrastructure, places frequented seasonally or periodically, etc.), and those, on the other hand, that can be supposed inhabited with a certain continuity by at least one demic unit. From the farflung farmhouse to the city, passing through nuclei of 'nebular' or atomised populations (separate or loosely-knit groups of houses, that are nevertheless reasonably close together) to various forms of agglomerated village (open, partially-fortified, fully-walled, etc.); and from the tiny village inhabited by a handful of families to the semi-urban situation of certain great castles or *borghi*, widespread in Tuscany and in the Po regions of Italy, and to some (like San Gimignano and Prato) which cannot strictly be defined as cities, since the term, in Italy, is applied exclusively to the centres of dioceses (Chittolini, 1990 and more relevantly for Tuscany, Zorzi, 1994).

Another problem must be underlined – one quite alien to the archaeologist but central to the utilisation of written sources: there exists a series of terms used in documentary sources, as well as a series of toponyms mentioned, that refer neither to sites, nor to settlements, but rather to areas or zones of varying size and function – administrative or ecclesiastical circumscriptions with or without a centre of habitation (they may have originated from an isolated church or bear the name of a geographical area or element, covering various diffuse or fragmented settlements); generically understood geographical zones, lacking in territorial demarcation or referred to without mention of it; landed property complexes, or patrimonial and farming units, the articulation of property, possession, and land-management; agrarian units, like the allotments for tillage, *terroirs*, etc. To clarify all this and to distinguish not only between site and settlement in their correct senses, but also between these and references to zones and landed property of various types, is an essential operation in the field of written sources if we hope to arrive at a not-too-contentious idea of the forms of population.

As we shall see in greater detail, we do not have a single available source which speaks to us directly and reliably about settlements before the modern age, nor sources such as to provide us with a picture of population or at least the social organisation of the settlement of the territory until the late thirteenth century. We must first draw out any indications relating to settlements, working on the casual and fragmentary mentions of place contained in sources that were produced with quite other purposes in mind and which refer to something quite different: land-holding and landed property above all, ecclesiastical organisation, concession of public rights to this or that holder of power, recognition of this or that political subject, and so on; mentions used to localise real estates, to indicate the places where the acts were drafted, the places or areas to which pertained this or that public right, territorial organisations of various types, and so on. From the twelfth century we start to find mentions of rural communities which have evolved into castles, villages or even 'nebular' nuclei of various composition and size. Only in the mid- to late thirteenth century will we find the first more-or-less complete lists, produced (by the cities) with the aim of framing the territory or of recognising rights over it, and the first fiscal sources for households. In these cases, too, however, we are not really dealing with settlement entities as such,

but nuclei of organisation (fiscal, administrative, judicial, ecclesiastical etc.) that originated from principal settlements and listed the 'minor' settlements as an aggregate part of them, or as being on a par with them – neither of which was the case.

THE VI–VII CENTURIES (c. 530 – c. 715)

Before the opening decades of the eighth century, or indeed for the long and turbulent phase that runs from the Graeco-Gothic wars to the consolidation of the Lombard kingdom, the panorama of written sources available for Tuscany (and more generally for Lombard Italy) is extremely limited (CDL I, II; Wickham, 1980; Violante, 1982: 972 et seq.; Adorni, 1983; Brown, 1984; Ceccarelli, 1985; Delogu, 1988: 150; Wickham, 1988a; Wickham, 1989; Cammarosano, 1991: 39 et seq.; Delogu, 1994b: 309 et seq.; Gasparri, 1994: 133; Citter and Kurze, 1995; Citter, 1995)[2]. There are no surviving writings produced *in loco*, nor archival documents, and, most importantly, after the collapse of Roman and Romano-barbaric fiscal systems and with these probably also the territorial organisation which was behind them (Gasparri, 1990: 237–291), there is a lack of any sort of source that might have restored a full picture of population and social-settlement nuclei – not only for this period, but also for successive periods up until the thirteenth century.

What is available is essentially this: certain letters or lives of the popes (containing news or descriptions of the territories invaded and their connected problems of ecclesiastical organisation); what has come down from the Lombard legislation; some sparse reports in chronicles compiled by external observers (Byzantines) or in hagiographico-literary works; and, finally, the reconstruction *a posteriori* of Paolo Diacono. These sources, besides providing very little information, present an insurmountable handicap to the understanding of the history of population and settlement: apart from a few exceptions they concern evidence of a very general character, lacking local anchorage or references to restricted and clearly-defined local ambits (Tabacco, 1973; Gasparri, 1990; Citter and Kurze, 1995)[3]. This is to be put down not only to the eminently narrative character of the sources, but also to the fact that very probably close-knit forms of territorial framework (judicial, administrative, politico-military, etc.) had not been maintained: the framework of the conquered populations ended up by being limited to the subdivision by *civitates* (Violante, 1982: 972 et seq.; Gasparri, 1990: 242–292). In that picture (which anyway represents only the point of arrival of a slow stabilisaton attained in the course of the seventh century) the question of where the population lived, how it was distributed and how great it was within the territorial units called *civitates* (corresponding more or less vaguely to dioceses) remains for the most part a mystery.

On a more general level, it may be said that for a period of almost two centuries in the written sources something approaching total silence falls upon settlement arrangements, forms of human occupation and their transformation, broken only by the handful of mentions of places, useful in indicating the antiquity of some sites later documented, but so few as to preclude any other evaluation (Valenti, 1994: 404–405; Cambi *et al.*, 1994: 199–203)[4]; by some hypotheses, by now less and less convincing, formulated in line with toponomastic traditions of Lombard origin (Delogu, 1988: 150–151); and finally by reports and descriptions – more or less catastrophic in tenor, but always from Byzantine and pontifical commentators (Adorni, 1983: 7; Ceccarelli, 1985: 20 et seq; Szabó, 1989)[5] – about the devastations wrought by the Lombards and on the environmental degradation in the territories and cities conquered or subjected to incursions. These are reports about which it is not easy to evaluate the short-term character and which must be considered biassed or at least tendentially hyperbolic descriptions.

Thus the question of the real impact that the Lombard invasion had, on the picture of a habitat perhaps already sorely tested and debilitated in its late Roman and Graeco-Gothic phases, remains shrouded in the densest mist. It is by now clear that such an invasion brought for many decades and for many areas – in particular those on the borders – an almost perennial state of war, and a climate of general geopolitical instability and indubitable difficulties of communication (Delogu, 1994a: 15 et seq.). That very probably gave rise to or accelerated – along with many other factors of a different nature (Wickham, 1988b)[6] – profound transformations in living-patterns and environment. In what direction such transformations moved (general collapse of population levels or murky twilight phases in which frontier zones declined while others recovered), is a question that remains, however, unresolved and, in terms of written documentation alone, insoluble.

Fortunately, however, we at last now have at our disposal material sources to interrogate on the subject. In the last twenty years the archaeology of late antiquity and the middle-ages has undergone an unprecedented development in Italy (Delogu, 1989, 1994a), and among its principal results can be numbered the recovery of archaeological visibility for the sixth and seventh centuries. For Tuscany we must also include the accumulation of a series of regional surveys, from which one can begin to evaluate the importance of the settlements already abandoned or decisively run-down before the Lombard age (Cucini, 1985, 1990a, 1990b; Cambi *et al.*, 1994; Valenti, 1994; Augenti, 1995; Citter and Guideri, forthcoming; Cambi, 1996). We are a long way from understanding what settlement forms substituted them, and from having reconstructed a more or less exhaustive and reliable map of population. The archaeological evidence attests to scattered houses or even summit agglomerations, but in too incomplete a way and with datings that are still too

vague: we are still far from being able to say whether the sixth and seventh centuries effectively represented a phase of further crisis in the lives of settlements, or if it is merely a question of a phase of intensive settlement transformation. We are beginning nevertheless to gather some major differentiations between the various areas of Tuscany, indicative perhaps of the flowlines of a slow, long-term redistribution of the population over the regional territory. From the map of the abandoned sites confirmed by archaeology, from certain documentary clues about the relative development of certain zones favoured by the new political and economic geography (Wickham, 1978, 1980, 1988a; Szabó, 1989; Farinelli and Francovich, 1994)[7], and from other archaeological indicators on the coagulation of certain nuclei of population of a certain consistency – in the areas traversed by the major road arteries of the Lombard era or perhaps in the important mining areas (Cucini, 1985: 301; Cambi *et al.*, 1994: 207–208)[8] – it may now be hypothesised that the population was on the move: not only from the plains to the hills, but also from the southern and Tyrrhenic zones towards more internal and northerly areas.

In conclusion, it may be said that the few written sources for this period serve only to provide archaeological research with a reference picture for the principal political events and for the greater, supralocal outlines of the institutional and geopolitical set-up. As for the history of settlements they provide little more than a few descriptions of debatable interpretation, in so far as they remain confined to only written documentation and some clues which assume full value only when combined with the richer information offered by the material sources. From the integration with these – whose quantity and quality grow year by year – it now emerges that the great unresolved questions for the period, and in particular that of the Lombard impact on the levels of population and their environmental framework, probably do not permit unequivocal or overgeneralised responses. The cut-off points with regard to the Roman and Romano-barbarian world are all quite evident and the abandoned sites of southern Tuscany perhaps constitute their most striking testimony. Be that as it may, something new was being born further north, in other zones and in other sites, in other forms of life-style and living-conditions... Now, at least, it is becoming clear that we do not know enough and that from the written sources we cannot expect to know much more about it.

THE EIGHTH–TENTH CENTURIES (c. 715 – c. 970)

From the first decades of the eighth century we have at our disposal archival documentation, although still very scarce and concentrated in very limited areas. It concerns in almost all cases private acts or diplomas issued by the principal public authorities, handed down to us through clearly-identifiable lines of documentary tradition, originating from a few cathedral churches (Lucca and, to a lesser extent, Pisa, Volterra and Pistoia), or from great imperial monasteries (San Salvatore at Monte Amiata and Farfa) numbered at the time among the major producers and conservers of documentation, and successively to become the hegemonic bodies for institutional continuity and the capacity for the construction of their own records (Bertini, 1818–1836; Barsocchini, 1837–1841; Pasqui, 1899–1904; von Glanvell, 1905; Schneider, 1907, 1911; CDL; Caturegli, 1938; Conti, 1965–1966b: 97 et seq.; Scalfati, 1970; *Regesta Chartarum Pistoriensium* 1973; Tabacco, 1973; Rossetti, 1973; Kurze, 1974–1982; Schneider, 1975; Wickham, 1980: 6–8; Cammarosano, 1987: 30–31; Wickham, 1988a: 8–12; Kurze, 1989: 3–22 and 295–374, 1991; Cammarosano, 1991: 49–61; Scalfati, 1992; Citter and Kurze, 1995)[9]. Such documentation, relating for the most part to the exchange or confirmation of possession of landed wealth, displays a local anchorage decidedly superior to that of the written sources of the previous epoch. In spite of that, the notable extensiveness and dispersiveness over the territory, typical of the great ecclesiastical and aristocratic properties of this period, ensure that such anchorage appears in a somewhat diluted form (CDL II, n. 203; Castagnetti, Luzzati, Pasquali and Vasima, 1979: 205–246)[10]. There are other cases, though, in which toponomastic notations are given relative to territorial ambits that are reasonably tightly circumscribed, corresponding therefore with sufficient margins of reliability to present topographical reality (Cammarosano, 1974)[11]. We begin anyway to find – particularly in descriptions of exchanged landed wealth – toponomastic and micro-toponomastic references of relative abundance, and the first terms indicating, perhaps, the social-settlement structures. References to intermediate or minor circumscriptional entities remain however relatively infrequent, – entities, that is, of inferior level with regard to the *civitas* or the diocese: they are sporadic in the dating of acts and frequently unrecognisable in other cases owing to the still-fluctuating spatial hierarchies of territory (Violante, 1977, 1982; Wickham, 1995: 64–92; Vaquero, 1990, for the Amiata area).

We are now in the presence of certain relatively well-documented areas – Garfagnana, Lucchesia, Amiata and, to a lesser extent, Maremma Populoniese – in which it is possible to reconstruct the major lineaments of agrarian countryside and landed wealth (Wickham, 1980; Ceccarelli, 1985; Wickham, 1988a, 1989). But the overall fragmentary and casual nature of the preserved sources still oppose very strong limits to the reconstruction of the social and structural fabric of the settlements. Many areas of Tuscany remain without coverage and it is also probable that – because of the mode of preservation proper to title deeds – even within the better-documented areas we may find a further selection in favour of those places or zones where in the course of the centuries the regime of property or of land exploitation remained relatively stable and constant. In the few documents relative to

settlements or areas with phases of evident discontinuity many place-names of difficult identifiability appear, and more generally it must be noted that areas of Tuscany exist in which the state of high-medieval micro-toponomastics is nothing short of disastrous (Kurze, forthcoming)[12]. The location of the sites mentioned and above all their classification are further obstructed by the rarity and uncertainty of references to circumscriptions of an intermediate size.

On that note we must enter into the crucial problem of these sources: the classification of place-names and the interpretation of the terms associated with them. The problem is that of reconstructing which were the techniques used by the *notarii* for defining locations, that is the system of toponymic references used from case to case by the drafters of the acts, for describing the landed property structures and the place where they drafted the act. Or indeed if and in which cases they used references to scattered houses, settlements or social-settlement nuclei of various degrees of agglomeration, and in which cases they made recourse to frames of geographical or agrarian reference, or to circumscriptions of an intermediate order (the village, the *pieve* or something of the kind) compared to that which originated from the *civitas* and which remained the principal horizon of reference. More particularly, the problem is understanding what the terms which originally referred to landed property, such as *curtis, cella, mansus, sors, casa et res* corresponded to, or rather in what sense they were used from case to case, and terms like *casale, vicus, plebs, locus, pagus,* which like that of *civitas* could indicate both the area of appurtenance and the place (inhabited or not) from which the circumscription originated, and, indeed, a geographical area not covered by the spatial hierarchization of territory.

As for the first group of terms, it should first of all be remembered that we are in a phase in which the domanial system is affirming itself, the landed property organisation by which the great patrimonies were articulated as *curtes* (manors) composed of nuclei of cultivation dispersed over the territory and by a *pars dominica* sometimes equipped with a centre (*domocoltile*) of collection and distribution of products (Toubert, 1983; Andreolli and Montanari, 1983; Toubert, 1986; Sergi, 1993: 7–24). It is not clear however what sort of settlement dynamic was behind this landed property organisation: some have speculated that the peasants lived essentially dispersed in isolated farmhouses (*case massaricie*), that is to say that mentions of *curtes, masie* and *sortes* (copyhold tenure) correspond to a settlement framework that was atomized or very fragmented; but there are also those who have shown how the domanial system, given the extreme fragmentation and dispersal of its constituent units, could have superimposed itself on any habitational or social-settlement model (Conti, 1965–1966b: 7–79; Toubert, 1983; Andreolli and Montanari, 1983; Toubert, 1986; Montanari, 1988; Sergi, 1993: 7–24)[13]. In substance, when we find mention of a *curtis* we have to think of a landed property complex of a very wide and complicated territorial articulation, and we cannot automatically refer the toponym that localised it to a settlement or to a site: perhaps it concerned the place where the *domocoltile* centre was situated (Castagnetti *et.al.*, 1979; Ceccarelli, 1985: 26–32)[14], perhaps it was the name of the zone where it or the *pars dominica* were situated, perhaps some other zone at which we can only guess. In the same way, when we come across *mansi, sortes* and farmhouses (*case massaricie*) we cannot be sure that we are dealing with an isolated settlement, because it could be that other proprietors owned houses and lands in the same place (and that this was therefore a village) without there being any surviving records. In reality, often the only way of identifying a village, beyond the hypotheses about the names of the *curtes* or about the existence and functions of *domocoltile* centres, is that of demonstrating by means of painstaking linkage that various mentions of farmhouses refer to one and the same place: *locus, casale, vicus* or whatever (Conti, 1965–1966b: 30; Wickham, 1988c). Rarely however is pre-1000 A.D. documentation sufficiently abundant as to allow such a linkage; and it is too scarce, too, for the construction of a stable glossary on the use of the terms *locus, casale* and *vicus.*

In conclusion, we still lack sources produced for a general framing of the territory for these centuries, and indications about settlements come from mentions of places casually contained in some hundreds of documents dispersed through the territory and relatively abundant only for some areas. The packet of toponyms which one can put together is thus irremediably casual and incomplete, apart perhaps from very limited zones, and to that must be added the fact that the percentage of those not localisable and above all those not classifiable for the purposes of the reconstruction of the intricate fabric of population remains rather high. The main problem remains that of the recognisibility of settlements among all the mentions of place, as well as the comprehension of the settlements and the material reality that lay behind terms like *curtis* or *mansus*, or even behind those like *casale* and *vicus.* These last indicate an area to which some form of agrarian or social-settlement organisation gave its name and identity, but its structure escapes us, and we in fact do not know whether they concealed scattered houses, constellated settlements, intermediate situations or already well-agglomerated nuclei.

The difficulties with this are so much the more serious in that there is still no hope of overcoming them by means of integration and comparison with archaeological evidence. This is without doubt the period in which it is most difficult to create a worthwhile dialogue between the two types of source. The archaeological visibility of the eighth-ninth centuries remains too scarce. If we examine the maps composed by juxtaposing the mentions of *curtes, case, vici, casalia,* etc. and the very few proofs of occupation datable to these centuries, it is easy to see that for the sites to which documentary information is

attributed there is no archaeological evidence, and vice versa. This means among other things that, save for a few exceptions, we have no possibility of comparing the term and the descriptive mentions given by the written sources with the traces of its archaeologically-evidenced material reality; and that these remain without names and without definitions, or at least without those that the men of that epoch gave to them.

It means more generally that because of the scarce, laconic and ambiguous nature of the written sources on the one hand and the limited archaeological visibility on the other, a great black hole remains over the eighth-tenth centuries, and whoever wishes to understand the long-term dynamics of settlement in order to obviate this black hole can advance only vague hypotheses: retrospective or based on considerations of the final phases of the late-antique period. Consider, for instance, those hypotheses concerning precastral centralisation on summit sites, derived in substance from evidence of the abandonment of the most important late-Roman settlements, from the discovery of phases of high-medieval frequentation of certain sites which were subsequently to become castles, and from the documentary evidence of the fact that many castles in certain areas bear the names formerly belonging to *curtes* or, more rarely, to *casalia* and *vici*. The hypotheses of an upward movement of the settlement towards the hilltops or of the early existence of agglomerated settlements without walls are certainly plausible. But are such processes to be dated to the chaos of the sixth-seventh centuries, to the political and economic stabilisation of the Lombard world of the eighth century, or to the recovery of the Carolingian and domanial framework of the ninth-tenth centuries? Can they be applied to wide areas of Tuscany, or do they concern only a few areas in which a certain form of exploitation of the resources favoured agglomerated life? Is it a question of phases and areas in which population levels plummeted and the few men remaining grouped together in a few locations? Or rather, zones and historical moments of relative recovery and reorganisation? And further: what effects did the domanial system have? Did it favour dispersal and fragmentation, did it give rise to village life (perhaps triggered by the development of the *domocoltile* centres), or did it leave things much as they had been? The questions remain in large part unanswered and the models put forward are predominantly retrospective. It is impossible to say if the number of settlements grew or diminished between the eighth and tenth centuries in comparison with the preceding period, either with the written or the archaeological sources, and for this period we lack even such indications as those deducible from the map of the abandoned sites of late-antiquity. What is left is merely the odd qualitative clue about a recovery possibly in progress in some areas from the ninth-tenth centuries, or reports about tillages or about the splitting up of the *mansus* and of the *pars dominica* of the *curtis*. It is not much.

THE ELEVENTH–TWELFTH CENTURIES (c. 970 – c. 1180)

In the first centuries after the millennium the documentary panorama grows decidedly more ample and the sources more abundantly available, as well as being distributed over the territory in a more homogeneous way. The principal episcopal sees and the major monasteries no longer constitute the only channels for the transmission of documentation: this period offers us documentary sources from capitular and minor monastic archives dispersed more or less throughout Tuscany, with the exception of the southernmost zones (Conti, 1965–1966b; Cammarosano, 1974; *Carte Certosa di Calci*; *Guida Generale*; Ceccarelli, 1985; Wickham, 1988a, 1990, 1991, 1992, 1995, 1996; *Carte Montecelso*; Cammarosano, 1993; *Carte Opera Metropolitana*)[15]. In the course of the twelfth century the documentary picture is further enriched by the most ancient communal documentation. The new city organisations, besides preserving and handing on documents of varied provenance including those of preceding centuries (Cammarosano, 1987)[16], themselves begin to produce certain texts, and among them the first compilations of normative law (Cammarosano, 1987, 1991: 125–159; among the most ancient normative texts preserved, see *Breve Consulum* I–II). All this, however, does not mean a genuine complete typological transformation of the documentary picture, which remains characterised by the preponderance of documents relating to transactions concerning landed property and the rights pertaining to it.

The significant increase in the available documentation determines – from the eleventh century on – an exponential multiplication of the mentions of places (which obviously cannot be simply interpreted as an increase in the number of settlements, since there is no reason to suppose that many of the sites referred to now for the first time were not already in existence). There is no certainty even for this period that among the casual mentions of places, all or even a majority of settlements are included in the zone under examination. The reconstruction of the settlement fabric nevertheless becomes gradually easier, through the strengthening of toponomastic records and the greater clarity of the terminology used. Many more documents are available for making internal comparisons of semantic values, and less dramatic oscillations are encountered in the terminology – probably owing to the emergence of more distinct forms of dwelling (from the use of stone, and so on) and to the solidification of hierarchies of settlements and the stiffening of the territorial framework. Particularly significant in this regard is the the fact that locational formulas for the place of the drafting of the act become more detailed and that in them references to more restricted circumscriptions become more and more frequent: *pievi*, parishes and also, from the end of the eleventh century, *curtes* connected with the castles or some other organisation of the rural community (Cammarosano, 1974: 23

et seq.; Violante, 1977; Castagnetti, 1985; Cammarosano, 1993: 35 et seq.; Wickham, 1995: 64–92)[17].

More particularly, one notices the reduction with regard to preceding centuries and even the disappearance of the use of terms of ambiguous interpretation like *casale* or *vicus*, while *locus* assumes the role of generic indicator for micro-toponomastic elements. The terms *casa et res*, *sors* and *mansus* are no longer used with reference to organic complexes of the *curtis* and, anyway, they too are dying out (Conti, 1965–1966b: 133 et seq.; Cammarosano, 1974: 34 et seq., 1993: 53–55. In general on the process of disaggregation of the *curtis*, see Comba, 1988b: 94 et seq.). The term *curtis*, however, remains, though it changes meaning completely and begins to signify more than anything the area of land pertaining to a fortified site. In the twelfth century – at least in certain zones – it will become joined with the term *districtus* in indicating the territory over which the *signoria di banno* (i.e. ban of lordship) exercised rights and powers (Violante, 1980, 1991: 347 et seq.; Wickham, 1996)[18]. There is also growing evidence of the use of new terms that are decidedly more stable in their meanings for settlements. The term *villa* becomes increasingly frequent – generally interpreted as a relatively agglomerated open settlement or at least as a social-settlement nucleus of a certain size and identity, it will also later be found as a centre of circumscription on a level with the castles, *pievi* and parishes (Cherubini and Francovich, 1973; examples from the Volterra region relating, however, to the thirteenth century, in Ginatempo, 1995). From the last decades of the tenth century appears the term *burgus* – in suburban appendages or elsewhere in the territory, but always to indicate agglomerated settlements positioned upon the road network (Cherubini and Francovich, 1973; with reference to the Amiata area, Wickham, 1989 and Vaquero, 1990). Starting from the late tenth century, too, references to *castra* and *castella* begin to multiply, terms charged with historiographic implications and therefore of delicate and crucial interpretation (Delogu, 1990; Wickham, 1990; Sergi, 1995)[19].

By now it is clear that we are dealing with centres for the exercising of power over men, fortified sites that are ever more substantial and therefore more easily identifiable on the territory compared to those of preceding centuries. This is true for us today, because of the imposing array of material evidence that survives, but also for the men of that epoch, for whom they must have represented the most significant landmarks. It is also clear that, both with a certain tardiness compared to the models from the Po regions and from elsewhere in Europe (i.e. perhaps only in the course of the twelfth century), and not perhaps predominantly, the castles came to assume an important institutional role as centres of circumscription (*districtus, curia, territorium*) taking in – at times – scattered houses, nuclei of habitation, churches etc. and subject – at least in some areas – to jurisdiction and signorial rights defined on a territorial basis (Wickham, 1996)[20]. It should be said however that the fortifications to which such processes gradually linked themselves may have been of the most varied sorts, especially in the initial phases where the use of perishable materials is widely testified to in documentary sources (Balestracci, 1990; Hubert, 1994), alongside which the use of stone came to distinguish the nobler part of the site[21]. And it should be emphasised that, while it has by now been established that in the following centuries in Tuscany the term corresponded to a walled village of significant size, for their very first phases the doubt remains that the *castra* could still have been, more often than not, merely signorial residences or centres for the collection of goods – as happened, for instance, in the Po regions (Settia, 1984). Definite information is still required about the dimensions, configuration and functions of the fortified sites of this period – and at the same time we are aware that the term *castrum* or *castellum* could have covered a great diversity of installations: from the isolated fortification, through the towers dotted among 'nebular' nuclei or partial agglomerations, via fully-walled villages, to 'quasi-cities'.

We are beginning, too, to understand that the fortification of certain sites may have exerted influences on the surrounding habitat, on the hierarchy of settlements and on the territorial organisation, yet these effects differed widely from area to area. The observation of settlement models validated for the successive centuries, suggests that in some areas (for the most part in the south of the region) there came about a centralisation of dwellings within the new castles, and that in other situations the open settlements resisted better or for a longer time, and that in others again (in the northern and east-central parts of the region) these remained predominant (Wickham, 1990)[22]. And this finds documentary confirmation on the one hand in certain cases (in the Amiata region), in which it would appear possible to perceive quite a rapid movement towards the centralisation of settlements; and on the other, certain areas (Lucchesia, Chianti, Berardenga, the *contado* of Florence) to which close study has been able to attribute, for this early period, tightly-knit populations interspersed with various fortified sites (Wickham, 1989: 108 et seq. for the Amiata area; Conti, 1965–1966b; Cammarosano, 1974; Wickham, 1988a, 1990, 1995 for the other areas; on the Chianti senese see also Valenti, 1994). From written sources alone, however, it remains difficult to get a better picture of the various situations covered by the term *castrum*.

Still greater difficulties are encountered in linking this to the settlement dynamics of the preceding periods. As we have seen, mentions of sites for the eighth-tenth centuries are few, of ambiguous interpretation and even more uncertain location. In some areas, for example, one comes across a correspondence between the names of certain obscure *curtes* and the names of the castles that are to succeed them – which could mean an effective fortification of the *domocoltile* centre of the *curtis* (or of the main village of those within its ambit) or equally well a simple transmission of the name of that area. Similarly, the

fact that in other areas (or cases) castles bear apparently new names – as on Mount Amiata – may well signify the fortification of newly-occupied sites, or, equally well, the fortification of sites not previously documented. The analysis of the dynamics of open or fragmented population is equally problematic, in that from this period onwards it starts to be less frequently mentioned in the sources, owing to the attraction of localising references away from it towards more distinct sites like churches, *pievi* and castles and the more stable circumscriptions originating from them.

Indeed it is no coincidence that in some zones the persistence of open settlements is testified to almost exclusively by the archaeological evidence, occasionally linked to documentary allusions on the minor ecclesiastical network (Cammarosano, 1974; Cucini, 1985: 147 et seq., 1990a: 253 et seq.; Valenti, 1994; Giorgi, 1994a; Ginatempo, 1995; Augenti, 1995)[23]. There are still, moreover, various cases of fortified sites datable archaeologically to the-eleventh-twelfth centuries, yet barren of documentary attestation (Cucini, 1985, 1990a; Valenti, 1994; Citter and Guideri, forthcoming). The parallel utilisation of archaeological and documentary sources does not however serve merely to render less patchy the reconstruction of the networks and the dynamics of settlement. Perhaps the most important contribution resides in the possibility of clarifying the habitative configurations, functions and dimensions in a wider case-history for *castra*, *ville*, *burgi*, *pievi* and churches. It is obviously of particular importance to clarify the term *castrum* in its tenth-eleventh century context, in order to re-establish a correct perspective and to avoid attributing to it characteristics which it may not assume until later epochs and in different contexts.

We will examine all this more fully in the following section, underlining for the time being two important points: 1) Starting from the phases of the eleventh-twelfth centuries, elements of comparison – and not only of integration – between documentary and material sources become available; 2) In order to be able to make correct comparisons it is necessary however to refine further the instruments of archaeological analysis, with the aim of delineating ever more minutely the chronological phases. From this period onward we can test directly the social-settlement and habitational glossary in the written sources against much higher-profile material evidence, though it should not be forgotten that phases of building reconstruction linked to the moments of major development in the castles in the thirteenth and fourteenth centuries have tended to obscure the preceding phases – sometimes definitively. The substance and functionality of settlements in the tenth-twelfth centuries (and their differences with regard to the succeeding centuries) are not easily recognisable, and often only emerge in the cases of prematurely-abandoned sites. That can give rise to teleological interpretations that lead to the consideration of such settlements as being abandoned because they were 'different', 'wrong', not equipped with the 'right' characteristics for evolutionary survival with the approach of the thirteenth century. To think that such settlements were a 'mistake' on the part of their founders is, however, incorrect, since – all things considered – we still do not know for sure what motivations and what functional roles were envisaged at their inception. It cannot be excluded that the development of the castles as important nuclei of population and of social organisation went well beyond the intentions and the capacities for control of their founders – bishops, abbots, counts or whoever (Cammarosano, 1989; Wickham, 1989: 133–137, 1990: 95; Cucini, 1990a: 253 et seq.; Ginatempo, 1995: 49–53 and 68–69)[24] – and that that was the 'mistake', rather than the lack of development in other sites of theirs.

Many cases are by now available in which sites can be described archaeologically in their various phases, and amongst them there are some in which stratigraphic investigations over many years have produced a great wealth of detailed information. On the basis of these and of the progressive refinements of the instruments for regional survey, for the analysis of building structures or more generally of the 'sopravvissuto' – high-profile surviving remains (Delogu, 1989) – many of the above difficulties seem set to diminish progressively. And the utilisation in conjunction of the two types of sources are already beginning to show some results. It seems possible to speculate that the effects determined by the *incastellamento* up until the beginning and middle of the twelfth century were still limited and decidedly less organic than might have been supposed by simply retrodating later settlement models. The latter, nevertheless, give us the heuristically productive idea of certain major geographical differentiations in the dynamics of population, settlement and demography. Many of these, for the eleventh and twelfth centuries, remain obscure, but it begins to become clear that in the northern and eastern parts of Tuscany castles were inserted into a settlement fabric both dense and widespread; and the impression is also conveyed that the open population for which there is evidence in some parts of south-western Tuscany was already decidedly less numerous and varied. We do not know if this represents a difference in demographic density: does, for instance, the less numerous open population signify a scarcer availability of men or merely a greater concentration of them within castles? The evaluation of the dimensions of sites, impossible through documentary sources, theoretically possible but extremely wearisome using material sources, is an undertaking still to be embarked upon – even simply on the level of primary comparisons between certain sample zones. And the retrospective extrapolation from the models of later centuries – which will be discussed at a later stage – can be highly misleading.

That is not all, however. From studies conducted on the structures of land-holding and landed property, as well as the forms of power connected with such structures (Conti, 1965–1966b; Cammarosano, 1974; Ceccarelli,

1985; Wickham, 1988a, 1989, 1991, 1992, 1996), there emerges a clear indication: in the areas of dense and widespread population we find – besides the weaker and less influential castles and signorial powers – much more complex structures of landed property, characterised by the widespread presence of large estates, by the importance of the medium and small holdings, and, more generally, by the presence of vital and dynamic rural classes. In the southern areas, by contrast, the greater importance of castles and a higher level of centralisation around them go hand in hand with a preponderance and greater compactness of the great properties (ecclesiastical and aristocratic), and noticeably more powerful, compact signorial estates that are deeply-rooted in the territory. Much of this is hypothetical, but the connections indicated remind us of how relations between settlement dynamics and demographic dynamics are by no means direct, the connection being not so much between themselves as with the forms of political and economic power. A crucial factor in the shaping of settlements and of habitational frameworks between agglomerated life and dispersed life on the one hand, demographic development or stagnation on the other, may have been the structure of landed property, or more generally, the exploitation of resources.

THE THIRTEENTH–FIFTEENTH CENTURIES (c. 1180 – c. 1450)

From the first decades of the thirteenth century we witness a genuine explosion in the quantity of written sources, produced and preserved in numbers unmatched by the preceding epochs. Along with this increase goes a radical typological transformation of the whole panorama of sources (Cammarosano, 1991: 125 et seq., 1987, for a close analysis of the Sienese case). Alongside cathedral, capitulary and monastic archives, there commences the copious preservation of those of communal institutions – including an ever wider variety of types – as well as the first fragments of the archives of the more important city families. Instead of the exhaustive exegesis of every scrap of information to be had from available documentation, it now becomes a question of choosing from the multitude those sources that are potentially useful (Pinto, 1988a). Unpublished sources become prevalent, there remain areas and documentary types that are largely unexplored, (increasingly so towards the fifteenth century), and all in all one cannot exclude the possibility that the picture of information potential – reconstructed through highly detailed (and acclaimed) research on the population and demography of late-medieval Tuscany (Fiumi, 1950, 1961; Conti, 1965–1966b; Fiumi, 1968; Herlihy, 1972, 1973; Del Panta, 1977; Fiumi, 1977; Herlihy and Klapisch, 1978; Fiumi, 1983; the contributions regarding Tuscany in Comba, Piccinni and Pinto (ed.) 1984; Ginatempo, 1988b; the contributions collected in Leverotti, 1992; Giorgi, 1994b; Pirillo, 1994; Ginatempo, 1995; ample bibliographical summaries in De La Roncière, 1982; Pinto, 1982; Ginatempo and Sandri, 1990) – may yet be further broadened and rendered still more accurate.

Among the most ancient communal sources, and of fundamental importance, are the oaths of submission of communities and lords of the territory. These sources – produced in the late twelfth century during the expansion of cities into the *contadi* and containing lists of individuals who made up the rural communities or who, at least, were called upon to swear to the various treaties – are the first that allow a documentary evaluation of the population sizes of settlements, albeit in a very approximate way (Fiumi, 1977: 98 et seq.; Cristiani, 1962; Fiumi, 1983: 127 et seq.; Varanini, 1994; Salvatori, 1994a, 1994b; Giorgi, 1994a, 1994b; Ginatempo, 1995)[25]. The central problem is to establish who exactly took the oath, whether they were the adult males, the heads of families subject to taxation by the *signori* (*domini castri*), men-at-arms, or only a more or less representative part of these (Giorgi, 1994b; more generally in Varanini, 1994 and Ginatempo, 1995). It is already clear, though, that such sources are reliable only on the occasion of the initial submissions or of particularly solemn acts, subsequently assuming a merely routine character, and becoming simple rites of obeisance performed only by representatives of the rural community. Another problem is that this documentation is rather incomplete: it is missing for places where the city does not reach or comes late, for a series of castles and abandoned villages and also for the zones nearest to the city, those where no rural communes or signorial powers were developed such as to render necessary formal acts of submission.

From the central decades of the thirteenth century sources begin to appear that finally give a programmatic framework to the territories: the areas subject to the authority of city communes. They are only available for some cities (Fiumi, 1950; Fiumi, 1968; Herlihy, 1972; Herlihy, 1973; De la Ronciere, 1982; Pinto, 1982; Fiumi, 1983: 140–142; Pinto, 1988a; Ginatempo and Sandri, 1990: 260; Leverotti, 1992; Giorgi, 1994a, 1994b; Ginatempo, 1995: 47 et seq.)[26] – they are lacking, for instance, in the case of southern Tuscany and also of Arezzo and Pisa – and it should be remembered, too, that the areas subject to the authority of the principal Tuscan cities, at least until well into the fourteenth century, covered relatively limited portions of territory – even if they were in a phase of expansion – and that they were not, at times, very compact nor of very rigid confines (Herlihy, 1972; De la Ronciere, 1982; Herlihy and Klapisch, 1978: 109 et seq.; Giorgi, 1994a, 1994b; Ginatempo, 1995; Redon, 1995)[27]. These are sources produced with the aim of outlining – fiscally, administratively, or jurisdictionally – the subject territories: lists of places covered by the magistratures and city statutes; lists of rural communities held to obligations of duty and service of various types, containing the number of households, men-at-arms, or merely the taxation figures (for Siena, Pistoia and Volterra); censuses

of *bocche* (mouths) – that is to say for the purpose of food supplies (only in the case of Prato); rolls of named taxable households or *fuochi* (hearths) (assessments for tax-purposes – *estimi* and *lire* – for Volterra, San Gimignano, Prato); and, in the case of Siena, a land-register (*catasto*) of the early fourteenth century (the *Tavola delle Possessioni*) containing the number of landowners and habitations present in a major part of the *contado* (Giorgi, 1994a, 1994b; Neri-Passeri, 1994. On the *Tavola delle possessioni,* Cherubini, 1974: 231–311 and the exhaustive bibliography in Cammarosano, 1983: 155).

In the vast panorama of late-mediaeval documentation useful to our purposes (more in general Pini, 1985; Comba, 1985, 1988a; Pinto, 1988a) should also be noted the chronicles (containing, in a number of cases, reasonably reliable figures for population)[28], as well as certain ecclesiastical sources, of primary importance among which the *Rationes Decimarum* (RD I and RD II, on which, Gambi, 1952; Pinto, 1982: 35–36, 1988a; Cammarosano, 1991: 98–100), produced by the pontifical authorities by systematic census of the ecclesiastical bodies subject to tithes over the whole face of the regional territory (it is the only source to cover the entire area); and also the lists of the holders of ecclesiastical benefices, preserved in the archives of certain city churches (Giorgi, 1994a)[29]. Such documentation – opportunely integrated with land-registers (*catasti*) and assessments of communal provenance – permit the thorough reconstruction of the ecclesiastical framework upon which in certain areas the civil circumscriptions continue to hinge (Szabó, 1984; Giorgi, 1994a; Wickham, 1995: 64–92; Ginatempo, 1996). This ecclesiastical framework is connected with sites that cannot strictly be termed settlements – and indeed in certain cases one can demonstrate that the churches were merely the scene of periodical gatherings, and that the names of the settlements were quite other (Violante, 1984; Szabó, 1984; Neri and Passeri, 1994)[30], and so on. It may be used, however, as an indicator of the form and distribution of settlement and population over the regional territory, since by this era the churches, whatever their localising designation, were generally linked to the care of souls in the villages, and to a system whereby each curate had in large part to be maintained with local resources, or at least to be able to count on a certain number of baptisms and burials in the course of the year (Violante, 1977, 1984; Cherubini, 1984: 217–245; Wickham, 1995: 64–92). To secure a curate was not easy either – since it meant subtracting resources from the principal churches (*pievi*). A larger number of churches therefore means more settlements and more people.

We begin, then – firstly on the basis of the sworn oaths, then, from the middle of the thirteenth century on the basis of fiscal, administrative and ecclesiastical sources – to be able to reconstruct maps of population and social-settlement nuclei that are increasingly reliable; to be able to evaluate the dimensions of sites, their functional configuration and the order of importance of settlements, on which the organisation of the territory hinged; and to be able to delineate the major regional differentiations in the distribution of population. We know that the castles of northern and east-central Tuscany had in some cases become great rural or semi-urban communities, while remaining, in many others, of little importance, blending in with a population that remained for the most part open and fragmented (RD II, map; cf. also Conti, 1965–1966b; Herlihy and Klapisch, 1978; Klapisch, 1981; De la Ronciere, 1982; Pinto, 1982; Violante, 1984; on the Sienese and Volterra region Giorgi, 1994a and 1994b and Ginatempo, 1995); and we can reasonably affirm that in southern and Tyrrhenic Tuscany, by contrast, an ample network of castles centralised and contained the greater part of the population, whereas the open or scattered settlements tended to disappear or to become quite insignificant (RD II, map; Redon, 1982; Giorgi, 1994a)[31]. We are also able to identify intermediate situations: the areas around the cities where there were no castles – or if there were their existence was fleeting (Wickham, 1990; Giorgi, 1994a; Wickham, forthcoming)[32]; certain *incastellate* zones where, however, the open population resisted more successfully (Cucini, 1990a; Ginatempo, 1990, 1995)[33], or where the structural fabric of the castles was palpably denser (Ginatempo, 1988b; Giorgi, 1994a)[34], and so on. And we can also broadly evaluate how – with some exceptions[35] – the levels of population in zones of prevalent settlement diffusion (that is to say, those of the centre-north) were comprehensively higher than those in zones where concentration within the great castles dominated the framework of living-patterns[36].

It must be repeated, though, that for the thirteenth century and much of the fourteenth, owing to the limited extent of the political entities that collected submissions or produced the framework sources, the regional territory continues to be covered only on the basis of sample zones (albeit large ones) of the centre-north, whilst for the other areas we only have an idea of the distribution and levels of population based on the *Rationes Decimarum.* And it should also be repeated that our understanding of the fabric of population, reconstructed through sources which now prevalently mention political subjects, fiscal-administrative units or social-settlement organisations – minuscule by current standards, but frequently embracing a number of different settlements (Conti, 1966a; Klapisch, 1983)[37] – remains largely approximate. Approximate, too, remains the evaluation of the dimensions of sites on the basis of the sworn oaths, community lists and fiscal sources regarding households.

It is only from the mid-fourteenth century, in fact, that the sources also begin to register the number of mouths to feed, the components of the family, as well as other more-detailed information which – along with the first sources indicating fluctuations (registers of deaths and baptisms for the cities of Arezzo, Florence and Siena) – allow a demographic analysis worthy of the name (Ottolenghi, 1903; Fiumi, 1961; Conti, 1966a; Fiumi, 1968, 1977; Del Panta, 1977; Herlihy and Klapisch, 1978; Fiumi, 1983;

Ginatempo, 1988b, 1989; Leverotti, 1992)[38]. And it is only from the start of the fifteenth century that blanket-analysis becomes possible for the greater part of the region, thanks to centralised and homogeneous sources for the cities contained within the Florentine state (the equivalent of two-thirds of the region), and to equally analytical sources for the state of Lucca (composed of the city itself and only a small *contado*) and to the much more fragmentary and laconic sources for the state of Siena (equivalent to almost a third of Tuscany, stretching down to the southern confines). Ample population studies have been conducted for these territories, including demographic dynamics, the structure of the family and kinship, and so on, some of them so well known as to obviate the necessity of other references (Herlihy and Klapisch, 1978)[39].

The wealth of information that one encounters in the fourteenth and fifteenth century sources is such as to shift the dialogue with the archaeological sources towards particular sectors, albeit closely-connected and sometimes fundamental ones, in the problematic of the history of settlements: paleodemography and paleopathology, alimentary and ecosystemic history (Ginatempo, 1984; Clark, 1987; Ginatempo, 1988a), the history of the exploitation of mineral resources (Farinelli and Francovich, 1994; Francovich and Wickham, 1994), etc. The archaeological sources may, perhaps, appear less essential, but it should not be forgotten that the written sources, in spite of everything, still retain certain lacunae (for southern Tuscany, for instance), clear paradoxes (on fragmented population, for instance) and various unresolved problems. We will cite one of them, historiographically dated, but not settled: the role of the late-medieval demographic crisis (from the mid-fourteenth century) in the abandoning of a rich series of castles and villages; the role of the same crisis in the processes of settlement selection whereby, of the numerous settlements attested to in the preceding phases, only a few survived – those destined to become the principal centres in our age (Ginatempo, 1988b, 1995)[40]. It is clear that many were abandoned before 1300, in the same process, perhaps, whereby other castles took on the character of great villages (Wickham, 1990: 89 note 17; Cucini, 1990a; Giorgi, 1994a; Ginatempo, 1995)[41]. And it is also clear that the meaning and causes of the dereliction of these sites (or their transformation into signorial residences or farmhouses) are profoundly different from zone to zone: in certain areas, for example, the movements in course during the thirteenth century gave way (in 1300 – 1500) to an inverse movement – in parallel with the diffusion of sharecropping (*mezzadria poderale*) – of a dispersal into scattered farmsteads, and the destructuring of rural communities (Conti, 1966a and b; Pinto, 1982; Klapisch, 1983)[42]; in other areas, where the population had never been greatly centralised, the castles simply lost their functions of lordly power and prestige or of the defence of territory, sometimes because the *signori* had already moved to the city (Pinto, 1982: 41–67, 1988b)[43]; in other areas again (perhaps in the fourteenth century, perhaps earlier) there was a collapse in the whole system of exploitation of mineral resources and forests which gave the communities their livelihood (Ginatempo, 1995)[44]; and so on. What still remains to be more fully explained is the role of the acute lack of people which characterised much of Tuscany from the second half of the fourteenth century, and in connection with that it should be emphasised that putting a date to the moment when sites were abandoned – using written sources – is by no means easy. Without going into detail, it will simply be said that the problems are dictated by lacunae and by either the geo-political fluidity or institutional sluggishness, by reason of which deserted sites were for decades registered as inhabited in order that rights over them should not be lost (Ginatempo, 1988b: 123–130); and that recourse to other documentary types (notaries, judiciaries, etc.) would in theory obviate these and many other problems, were it not for the unmanageable extensiveness of these sources (Pinto, 1988a); and, therefore, that dating the abandoning of a site to before or after the Black Death appears, for the time being, easier using archaeological remains rather than written sources, that are, by this time, all too abundant.

In Italy, the principal points of dialogue between archaeologists and historians have so far given precedence to the thirteenth century, with interest focusing on themes relating essentially to the tenth – thirteenth centuries, that is to say to dynamics such as *incastellamento*, the development of the rural *signoria* or economic and demographic expansion, with respect to which the thirteenth century is designated the point of arrival[45]. This also derives from the fact that many aspects of these dynamics are not well-illuminated by the sources until their final phases (when demographic pressure reached its height, the rural *signoria* came into harsh conflict with the cities and the more-or-less developed rural communities, etc.) and entail certain risks (Cammarosano, 1974, 1993).

Consider, for example, the relationship between churches and castles. From the documentary sources – on the basis of the thirteenth century ecclesiastical fabric and a cluster of mentions only really abundant for some areas – we can posit a process whereby the castles in certain areas gradually attracted to themselves the function of the care of souls, once exclusively the preserve of the rural *pievi*, founding new churches or sometimes translating the *pievi* themselves (Toubert, 1973; Violante, 1977, 1984; Settia, 1984; Szabó, 1984; Cherubini, 1984; Ceccarelli, 1985; Ronzani, 1989; Cucini, 1990a; Sergi, 1995; Wickham, 1995)[46]. We do not know for sure when this process dates from, or from what moment the churches situated inside or adjoining the castles began to take over the care of souls (and in particular the right to perform burials), generally the sign of socio-religious activity and collective identity. To be able to establish a precise date would mean being able to say that from that moment the castle is undoubtedly a village, with a certain number of inhabitants capable of organising themselves and of obtaining their own curate. The architectonic evidence of the churches connected with

castles (as indeed for the very numerous churches connected with open settlements covering the north of the region, where the castles are not dominant) would date their appearance to the end of the eleventh century (Moretti, 1983, on Florentine *contado*, 1995, on Volterra; cf. also Cucini, 1985, 1990a; Valenti, 1994), but it does not tell us if at that period these were simple private chapels belonging to local lords, or village churches. The archaeological evidence concerning the cemetery areas eventually associated with the castral churches can tell us much more. In the case of Rocca San Silvestro (Francovich and Gruspier, this volume), which is the only in-depth study, the entire sequence has been reconstructed – foundation of the castle, foundation of the church, aristocratic burial and, finally, and here we are on the threshold of the thirteenth century, burial of the people of the village – which serves to emphasise that the acquisition of responsibility for the care of souls and perhaps also the development of the castle as a nucleus of demographic and functional centralisation are relatively late phenomena[47]. Other investigations – in the case of Radicondoli, in an area where the open population resisted best – seem to confirm this chronology, testifying to an initial diffusion of rural churches connected to nuclei of open population or to 'minor' castles, followed in the late twelfth century by a rapid development of certain castles and their churches, to the detriment of other castles, parts of the open population, and their respective churches (Cucini, 1990a, but on the neighbouring area of Volterra Ginatempo 1995; Augenti 1995). Such examples reaffirm that, behind the illusion of continuity created by the permanence of the term *castrum* or *castellum* in the documentary sources, by the names of the better-defined sites, and by the more imposing edifices or ruins, there lies a diversity of social and functional realities, layered one on top of the other, as well as being much more contrasting and variegated than a crude retro-dating of the salient elements – in this case the functions of the thirteenth century castle – might lead one to believe.

There are many other examples that could illustrate the same theme, but we will invoke only one, concerning the relationship between political and economic power (in particular, the *signoria territoriale*) and the distribution and levels of population. Ample studies have recently demonstrated that it is not until the mid-twelfth century that strong signorial powers assert themselves in Tuscany (along the lines of those of the Po regions and elsewhere in Europe) and that only in southern Tuscany and the Tyrrhenic zones (where by the end of the thirteenth century population appears weaker and concentrated almost entirely in the castles) do they assume strong, assertive and dominating forms (Wickham, 1966; cf. also Wickham 1989, 1992, 1995). The retrospective connecting of inferior demographic growth with superior strength of signorial powers seems to be reasonably certain, but it would be helpful to understand more clearly whether the two phenomena proceed in parallel, or if the second is in some way the consequence of the first (whose Tuscan peculiarity would be that the *signoria territoriale* develops late and only where it finds the population already centralised, but not too vital), or if, instead, it precedes and determines it. The studies also emphasise, as we have already mentioned, the connection between strong signorial powers and the preponderance of the great landed properties and the lower economic vitality of the rural classes. Such a model – that connects power and land concentration, settlement centralisation and lower demographic development – is further substantiated thanks to the integrated use of both written and archaeological sources, in the examination of one case (Rocca San Silvestro, as mentioned above), in which the structures of political and economic power hinge, not on land, but on the exploitation of mineral resources (Francovich and Wickham, 1994): an extreme case (being abandoned definitively in the early fourteenth century, and with untrammelled and assertive forms of *signoria*), but paradigmatic of central and south-western Tuscany where there were probably many castles whose economies were based on metals, that is to say on a resource which was entirely under the control of *signori* (*domini castri*), through forms of management more complex and at the same time more easily monopolizable than agrarian ones. In comparison with other cases (a Tuscan city or a substantial rural community in the Po regions) in which the exploitation of mineral resources had passed into the control of communal institutions and in which a much more abundant documentation has been preserved, owing to conflicts with the ancient lords, the case of San Silvestro may be seen to be paradigmatic also for those areas where the signorial powers were so dominant as to preclude the very idea of conflict, thereby leaving no written but only material traces of its past. And for all those cases in which agglomerated patterns of life had no corresponding vitality among the rural classes, but saw only their complete subservience and a profound imbalance – this perhaps did not directly cause the stunted demographic development and the ultimate abandoning of the site, but must have meant that with the changing context (the system of production and commercialisation of metals) and functions (those of the signorial castle), the settlement was no longer capable of re-inventing itself in terms of an alternative *raison d'etre*.

Finally, it should be remembered that for the study of the distribution of medieval population it is extremely important that sources from the following epochs and historical erudition be used correctly. We are not advocates of the regressive method, but it must be said that toponomastic investigation is often only possible thanks to records of locality handed down from a more modern age (from the cartography and from the assessments of the sixteenth and seventeenth centuries to the land-registers – *catasti* – of the nineteenth), or in the inventories and other erudite compilations from the seventeenth century and containing extracts of lost documentation. Be that as it may, the use of post-medieval materials, as with that of any retrospective element (as when those of the 13th/14th centuries are used to explain the dynamics of

the 10th-13th), must serve exclusively technico-philological ends – to amplify the capacity of memory we still have, using 'records contained in other records' ('memorie di memoria'), that is documentation that in some way registers which information in and of the territory has been preserved in the preceding age. In doing so, it is necessary to avoid any form of retro-dating, distinguishing that which concerns the age in which the source was produced from that which may turn out to contain the memory of an earlier epoch. In this game of mirrors it is easy to fall into errors of perspective, or to formulate inappropriate questions, when one is dazzled by the ever richer information furnished by more recent sources; just as it is far too easy to create illusions of continuity about the structures of habitat and rural life (which, in reality, never stand still), giving precedence to the major evolutionary lines that seem to lead directly to where we stand now, or which have left deeper and richer memorials to themselves, while the intermediate phases, the buried dynamics, and all that which seems altogether more wearisome to reconstruct, is left to languish in neglect.

CONCLUSIONS

We conclude, then, with the question of the relationship between demography and settlements. If one starts with the documentary sources, the problem of inferring size of population from trends in the number of sites (or the absolute figures for population) does not arise – or it arises only from the end of the thirteenth century, because before that date we have qualitative clues about the current demographic tendencies (particularly in cases of expansion), without being able to know how many settlements there were, because they are reported sporadically until the tenth century and still fairly patchily until the thirteenth (especially if things are considered on a regional scale or for large areas of territory). From the end of the thirteenth century that problem could theoretically be posed (if in counting the number of settlements in sources of a different nature the *de facto* insurmountable questions of the classification of sites were not asked), in order, say, to get around the lacunae in the least-well-documented zones; but the second problem is posed – whether one can infer from settlement densities those of a demographic order. By referring to the *Rationes Decimarum* we can get some sort of an idea, albeit an approximate one, about the distribution of population over all the regional territory, whilst the other sources still only cover some sample areas.

The more general question then arises about the relationship of demographic tendencies (expansion, stagnation, contraction) and settlement tendencies (dispersal, centralisation), as well as between forms and levels of population. Did the demographic dip and the lack of men lead to the abandoning of sites and centralisation elsewhere, or to diffusion over the countryside? Does a smaller number of sites mean fewer men or simply larger and more concentrated settlements?

This rapport seems to us to be highly equivocal and complicated by the whole series of factors that lay behind the very origin of the settlement tendencies on the one hand and the demographic trends on the other. More often than not, one begins to suppose not so much that the former influenced the latter or vice versa (we do not even know how), as that the characteristics of the forms of political and economic power, or the social structures specific to a given situation, acted both on the demographic trends (leading to a growth or decline) and on the dynamics of settlement (favouring agglomerated life, for instance, or the rural homestead, or the small nucleus), without there being a direct relation between the two tendencies. In late-medieval Tuscany one can see with some clarity – there are those who would even retro-date this model to the preceding phases – that the zones of prevalently dispersed rural population, where, apart from the cities and the semi-urban castles, people lived for the most part in small groups of houses thickly spread over the territory, were the zones of denser and more energetic demographic development (Conti, 1965–1966b: 211 et seq.; Klapisch, 1981; Pinto, 1982: 35–36 and 41 et seq.; Klapisch, 1983: 15 et seq.)[48]. This is linked to a complex of causes, including the presence in these zones (north and east-central Tuscany) of almost all the cities; it is part of a context of great imbalances and differences between these zones and southern and Tyrrhenic Tuscany, and it cannot be said to constitute a rule (not even for Tuscany itself, where certain highly centralised areas boast high populations thanks to the profusion of substantial castles)[49], nor does it suggest direct connections between settlement and demography. It suggests rather, together with studies of the preceding periods (see sections 3 and 4), connections over a long period (in the south) between the concentration of power and the control of resources by a few people on the one hand, and the centralisation in castles and a weaker demographic development on the other.

If it is not possible to proceed to an accurate functional and, above all, dimensional classification of sites, and if it is not possible to equip oneself with other instruments of evaluation (like those referred to in connection with the *Rationes* in section 4), the number of sites does not tell us an awful lot. This has been amply emphasised by Sbonias (this volume), but perhaps some rapid annotation from the point of view of written sources may be of use. Confirming the abandoning of various sites in a certain phase does not, in fact, permit the inference *tout court* of demographic collapse (even if the sites are very numerous), still less that it is the origin of the abandonment itself: the inhabitants may have simply moved elsewhere, to other areas and sites whose dimensions we do not know (or which remain unascertained for reasons of contradictory documentation, poor archaeological evidence, etc.). On the other hand, even a marked increase in the number of sites (supposing one manages to confirm it – something that for

much of the middle ages is still not possible) may merely mean an increase in the geographical mobility of the population and a precariousness of sites, or a temporary, provisional role of settlements, especially if one adopts broad time-scales of more than one century.

The increase in sites may also simply mean an increase in the degree of dispersal and fragmentation of the population, as happens in the fifteenth century in the north and east of Tuscany, where there is a pervasive diffusion of an agrarian system based on the concentration of landed property in the city and on the sharecropping management of individual farming units, which gradually become equipped with farmhouses (Pinto, 1982: 41–67; Piccinni, 1992)[50]. The demographic behaviour of these areas – as we have mentioned – appears to enjoy greater vitality than other Tuscan areas, those of a high level of centralisation, though it should be remembered that this is a relative evaluation and that this all took place in a phase of grave and well-attested demographic crisis: here it is simply a little less dramatic (Pinto, 1982: 67 et seq.; Ginatempo, 1988b). And another aspect should also be emphasised. Behind the increase in the number of settlements, or more accurately behind the number of their names revealed by the written sources of this period, hides a process of destructuring of rural society and of the social organisation of settlements, in which up to the thirteenth century the population was grouped (for payment of taxes, for the fulfilment of various labours and services in the collective interest, etc.). Their functions diminished, even at the level of local identity, smaller and more atomised units began to prevail, and there was a need for more names to identify them by. In some areas it was simply a question of the nominal increase in sites (because previously units had been referred to which in reality took in several scattered houses or several nuclei); in other areas, however, it is a question of a genuine increase, because reference had previously been made to centralised units now abandoned by an increasing number of families in favour of new farmhouse settlements[51]. In neither case did this mean social, economic or demographic development; what can be deduced is simply a greater capacity for recovery than that witnessed in southern Tuscany (Klapisch, 1981; cf. also the more recent Pinto, 1990).

All these observations can only be made about the fourteenth-fifteenth century period for which detailed and extensive sources are available, a period which, not coincidentally, is viewed by many as the start of the modern age rather than the final phase of the middle ages. For the preceding phases much less, sometimes virtually nothing, can be done, and on the relationship between demography and settlement before the thirteenth century one can only advance hypotheses. And one can highlight what is not known and formulate pertinent questions, as we have attempted to do concerning the impact of the Lombard invasion (demographic collapse or redistribution of the population? A fleeing to scattered housing or a concentration in fewer places?); and concerning precastral centralisation (does it date from the period of crisis, or from the reorganisation of the landed property in the domanial system, or from the demographic recovery associated with the crisis of that system?); and concerning the castles of the tenth-twelfth centuries (poles of organization of population as in the following centuries, or not yet?).

Somewhat more can be done for the thirteenth century (we are beginning to understand, for instance, that the success of the castles as poles of centralisation is linked in the south of the region to the economic and social weakness of the rural classes), and especially for the final part of this century, thanks to the *Rationes*. The texture of the fabric reconstructed from these does not, as we have seen, coincide with that of the settlements. What is by now highly advanced knowledge of the socio-religious organisation (together with studies of population in certain sample areas) permits us to infer from the denser growth of churches in northern Tuscany and in much of the territories of Siena and Arezzo a burgeoning of the number of settlements and – still more – of men. It is the first clear sign of the model – peculiar to late-medieval Tuscany, but not strictly applicable elsewhere in space or time – whereby in areas of particularly high population the people lived in cities, in certain large semi-urban centres, and, above all, in small nuclei spread densely over the territory; whereas elsewhere people lived agglomeratively within a small number of castles. That there were not enough men to cover the territory of the south with little settlements – as in the north – is probable. Understanding why is another matter.

translated by Richard Hinchliff

NOTES

* This paper is the result of reflections developed together. Maria Ginatempo wrote the first three sections; Andrea Giorgi wrote the last two sections.

1 Some considerations of the major potentialities of this sector (which opens up fields that were inaccessible for those who work exclusively with documentary sources, at least as late as the fifteenth century) are discussed in Ginatempo, 1988a.

2 In general Cammarosano, 1991: 39 et seq.; Delogu, 1988: 150, 1994b: 309 et seq.; Gasparri, 1994: 133 and CDL I, II. Tuscany is richly endowed with quantities of sources for the Lombard age, but that is true of the archival documents from the eighth century (see *infra* and Citter and Kurze, 1995 for the sixth to seventh century). See also Violante, 1982: 972 et seq. and Adorni, 1983. For some Byzantine sources (on defensive systems along the coast in the sixth century), Citter, 1995 and Brown, 1984. In the archives of Lucca there are preserved only 2 documents in copies of the years 685–700 (cf. CDL I, nn. 7, 12); the document of the year 654 relating to the controversy between Siena and Arezzo for the control of certain *pievi* and churches is of Aretine tradition). See also

how the noted works of Wickham, 1980, 1988a, 1989 on Lucchesia, Garfagnana, Amiata (as indeed Ceccarelli, 1985 on the Scarlino-Populonia area) take as their starting point the eighth century.

3 It is an arduous undertaking even to identify the confines that the Lombard dominion gradually reached in Tuscia or those (equally variable) of the duchies in which it was being structured (Citter and Kurze, 1995). The exceptions concern the controversy between the bishops of Siena and Arezzo (disputed in several episodes between the eighth and thirteenth centuries, with reference to an initial compromise of c. 650), on which see Tabacco, 1973: 163–169 or Gasparri, 1990: 242–244.

4 For the most part this concerns churches – because documents have been preserved only for ecclesiastical controversies or because these have been recorded in pontifical sources – but this obviously does not justify the hypothesis about a possible function of religious sites in the coagulating of nuclei of population, e.g. Valenti, 1994: 404–405 and Cambi *et al.*, 1994: 199–203.

5 Most noted those of Gregorio Magno, utilised e.g. in Adorni, 1983: 7 or Ceccarelli, 1985: 20 et seq. We should also remember a travel narrative of the mid-seventh century (which concerns the territories crossed by the major arterial road of the Lombard world, called Francigena in the following centuries), on which e.g. Szabó, 1989.

6 Like the major availability of resources for the rural classes, deriving from the diminishment of roman fiscal burdens, cf. Wickham, 1988b.

7 For Lucchesia Wickham, 1978, 1980 and 1988a; for indications of the energetic expansion of Siena and of its *gastaldato*, see note 3. For the Amiata-Val di Paglia area (and more generally for the zones traversed by the Francigena) Szabó, 1989. For the Populoniese-Rosellana area, there are hypotheses of an essentially retrospective nature in Farinelli and Francovich, 1994.

8 For the Valdelsa indications of this kind from the very recent excavations in the area of Marturi-Poggibonsi directed by Marco Valenti; for mining in the Maremma cf. Cucini, 1985: 301 (for the most ancient phases of Scarlino and Alma); Cambi *et al.*, 1994: 207–208 and personal communication from Silvia Guideri (for other cases identified in surface studies, but still being interpreted).

9 In general Cammarosano, 1991: 49–61. For the consistency and geography of the documentation see CDL; Schneider, 1907 and 1911 (for Siena and Volterra); Caturegli, 1938, to compare with Scalfati, 1970 and 1992 (Pisa); *Regesta Chartarum Pistoriensium* 1973; Bertini, 1818–1836 and Barsocchini, 1837–1841 (Lucca); Pasqui, 1899–1904 (Arezzo); Kurze, 1974–1982 (Amiata) and the summarizing graphics in Kurze, 1989: 3–22. See also Conti, 1965–1966b: 97 et seq.; Wickham, 1980: 6–8 and 1988a: 8–12. On the imperial monasteries Schneider, 1975 and Kurze, 1989: 295–374. On the loss of the ancient Florentine, Sienese and Aretine episcopal archives see Conti, 1965: 97 et seq.; Wickham, 1988a; Cammarosano, 1987: 30–31. That of Pistoia is also missing, but many papers presumably originating from it are preserved today in the Archivio di Stato di Firenze, see *Regesta Chartarum Pistoriensium* 1973. The archives of the dioceses of southern Tuscany, that is Populonia-Massa, Roselle-Grosseto, Sovana and Chiusi (apart from a few items from communal parchment collections of Siena and Massa) are also almost completely lost (see e.g. Tabacco, 1973 and Rossetti, 1973) as indeed those of the major monasteries like Monteverdi, Sant'Antimo and Sant'Eugenio. On documents of Farfa, a laziale abbey with properties in southern Tuscany, see Kurze, 1989: 3–22 and Citter and Kurze, 1995. See von Glanvell, 1905 and Kurze, 1991 for the so-called 'elenco di Deusdedit', produced between the eleventh and twelfth centuries on the basis of more ancient documents relating also to Tuscia. There are also isolated documents of the eighth to tenth centuries in the documentary tradition relating to minor monasteries, capitulary archives or communes containing for the most part documentation post-1000 A.D.

10 As for example in the *carta dotis* for the monastery of Monteverdi of 767 (CDL II, n. 203), or in the inventories of the church of Lucca in the ninth century, on which see *Inventari altomedievali*, n. XI: 205–246.

11 As in the *carta dotis* of Warnefrit for the monastery of Sant'Eugenio near Siena of 730, or in that of Winigisi for San Salvatore di Fontebona of 867, on which see Cammarosano, 1974.

12 That goes e.g. for the areas of the Maremma grossetana and of the Albegna valley, in which cases certain documents of the archive of San Salvatore al Monte Amiata are attributable to them only in so far as they contain general references to the dioceses to which the documents belong (Roselle and Sovana), on which Kurze forthcoming and personal communication from Wilhelm Kurze.

13 For an interpretation which suggests the hypothesis that the *curtis* system corresponded to sparse settlement patterns, see Montanari, 1988.

14 If it existed at all, this would have functioned only as a deposit for agricultural products. For some descriptions see Castagnetti, Luzzati, Pasquali and Vasina, 1979, used by, among others, Ceccarelli, 1985: 26–32.

15 See, among others, references contained in Conti, 1965–1966b (Passignano, Badia Fiorentina, Capitolo di Firenze); Cammarosano, 1974 and 1993 (Berardenga, Badia a Isola); Wickham, 1988a, 1990, 1991, 1992, 1995 and 1996 (documents from Lucca, Arezzo and Florence) and Ceccarelli, 1985 (San Quirico a Populonia). Among the most recent published sources *Carte Certosa di Calci*, *Carte Montecelso* (Siena), *Carte Opera Metropolitana (Siena)*. For a general overview on parchments preserved in the Tuscan Archivi di Stato, cf. *Guida Generale*.

16 In *Diplomatico delle Riformagioni* of the Archivio di Stato di Siena e.g. (or in the *Caleffo vecchio*, *liber iurium* of the thirteenth century, on which Cammarosano, 1987) documents of pre-communal age are preserved, mainly of ecclesiastical provenance.

17 In general Violante, 1977 and Castagnetti, 1985, but see also Cammarosano, 1974: 23 et seq. and 1993: 35 et seq. (for Berardenga and the Badia Isola area) and above all the recent analysis by Wickham, 1995: 64–92 regarding the establishment of the territorial character of the parishes and on the development of rural communities in Lucchesia.

18 Cf. Violante, 1980 and 1991: 347 et seq. and Wickham, forthcoming, for the late arrival of such phenomena in Tuscany, the limited forms they assumed in the centre-north of the region and the total absence in the environs of Lucca and Pisa.

19 For an historiographical outline of the problems of fortification Delogu, 1990 and Wickham, 1990. See also the recent considerations in Sergi, 1995 (an introduction to a collection of essays by Pierre Toubert).

20 See also note 18.

21 This is particularly evident from archaeological sources and especially from the case of Rocca San Silvestro (personal communication from Riccardo Francovich and Giovanna Bianchi).

22 The question has been raised, with typological proposals by zone, in Wickham, 1990.

23 See Cucini, 1985: 147 et seq. (for the Scarlino area) and Cucini, 1990a: 253 et seq. (for that of Radicondoli). Similar dynamics to the latter in the neighbouring area of the Montagna

Volterrana, on which Ginatempo, 1995 and Augenti, 1995. On the Chianti-Berardenga Valenti, 1994 and Cammarosano, 1974. On the rather modest profile assumed by the castles in the settlement fabric of the central portion of the Sienese *contado* see also Giorgi, 1994a.

24 On the many cases of castles whose development went beyond the plans of their founders Wickham, 1990: 95 (in Lucchesia, Valdarno, Valdelsa), 1989: 133–137 and Cammarosano, 1989 (Amiata), Cucini, 1990a: 253 et seq. (Radicondoli and Belforte) and Ginatempo, 1995: 68–69 and 49–53 (Montecastelli, Pomarance, etc.).

25 Fiumi had already used records of oath-swearing in the Siena-Volterra area for demographic purposes (Fiumi, 1977: 98 et seq. and 1983: 127 et seq.). An interpretation of the list of the Pisans who took the oath of peace with Siena, Pistoia and Poggibonsi in Cristiani, 1962; another more detailed interpretation in Salvatori 1994a and 1994b; for a systematic analysis of oath-swearing documents in the Siena and Volterra areas see Giorgi, 1994a and 1994b and Ginatempo, 1995. More generally, cf. the considerations of Varanini, 1994.

26 For Pistoia the very ancient *Liber censuum* of 1244, on which Herlihy, 1972; on the lists of Sienese households (*fuochi*) of 1278 and on the use of the *Tavola delle possessioni* of 1318–1320 for demographic purposes Giorgi, 1994a and 1994b, while on the list of 'capo fameglie' of 1328 reported by a chronicler Ginatempo and Sandri, 1990: 260; on the list of *armati* of the territory of Volterra in 1320, Fiumi, 1983: 140–142 and Ginatempo, 1995: 47 et seq.; on the census of *bocche* in Prato of 1339, Fiumi, 1968; on *estimi* for Lucca of 1331–1332 Leverotti, 1992; the data on the Florentine *contado* provided by the noted chronicler Giovanni Villani may have been taken from analogous sources (Fiumi, 1950 and De la Ronciere, 1982); only later sources for Pisa, on which Herlihy, 1973. More in general cf. Pinto, 1982 and 1988a and Ginatempo and Sandri, 1990.

27 See the case of Volterra in Ginatempo, 1995 and that of Siena in Redon, 1995 and Giorgi, 1994a and 1994b. The difficulty in identifying the territory referred to is moreover one of the main problems in the evaluation of density in the Pistoian and Florentine *contadi* (Herlihy, 1972; De la Ronciere, 1982; Herlihy and Klapisch, 1978: 109 et seq.).

28 See note 26.

29 For the case of Siena, on which a study is currently underway by Laura Neri, see Giorgi, 1994a.

30 For the *pievi* as places of periodical gathering see Violante, 1984; for the non-correspondence of the networks see e.g. Szabó, 1984 and the recent cartography (for the *contado* of Siena) in Neri and Passeri, 1994.

31 We know this thanks to RD II (map), but cf. also Redon, 1982 and Giorgi, 1994a, for the northern Maremma senese.

32 Giorgi, 1994a for Siena, but cf. the considerations in Wickham, 1990 and 1996 on the Sei Miglia of Lucca and on the area around Pisa.

33 As in Alta Val di Cecina, on which Cucini, 1990a and Ginatempo, 1995, or in Val d'Orcia, on which Ginatempo, 1990.

34 That is to say the strip of territory on the south-western confines between Amiata and Valdichiana, whose population appears denser than the Sienese areas of dispersed population (Giorgi, 1994a and Ginatempo, 1988b). It is an important exception because it contrasts with the Tuscan model of that time, which will be considered in the conclusion.

35 See the preceding note.

36 See note 32.

37 On the units of the *Rationes*, see above.

38 On the *estimi* for Lucca Leverotti, 1992; on the Florentine *catasto* of 1427 Conti, 1966a; Fiumi, 1961, 1968, 1977 and 1983 (Volterra, San Gimignano and Prato) and Herlihy and Klapisch, 1978. For southern Tuscany there is a lack of sources of this type, see Ginatempo, 1988b and 1989. For sources concerning population fluctuations Del Panta, 1977 (Arezzo); Herlihy and Klapisch, 1978 (Firenze); for Siena only Ottolenghi, 1903.

39 Esp. Herlihy and Klapisch, 1978, but see the preceding note.

40 The problem is posed (for Siena and Volterra) in Ginatempo, 1988b and 1995.

41 This seems clear for the Val di Cecina, on which Ginatempo, 1995 and Cucini, 1990a; but see also Giorgi, 1994a and a note in Wickham, 1990: 89 note 17.

42 Cf. also Ginatempo, 1990 and 1996 and as below in the conclusion. In general Comba, 1985: 392–395.

43 See also note 50.

44 E.g. in the cases of Rocca San Silvestro and Rocchette di Cugnano, the subject of stratigraphic investigations already cited. See also Ginatempo 1995.

45 The same tenth-thirteenth century periodization appears historiographically convincing e.g. in Sergi, 1990 and 1995.

46 See especially the rigorous study by Ronzani, 1989. On the *pievi*-system in the Scarlino and Radicondoli areas see Ceccarelli, 1985 and Cucini, 1990a. Such works frequently take as their bases the model reconstructed for Lazio by Toubert, 1973, as is underlined in Sergi, 1995. Important clarifications in Wickham, 1995.

47 Personal communication from Riccardo Francovich.

48 As regards density, see e.g. Klapisch, 1983: 15 et seq. (for the early fifteenth century); and Pinto, 1982: 35–36 and 41 et seq. (also for the end of the thirteenth century, based on the *Rationes*). On the greater vitality of the reproductive and migratory dynamics Klapisch, 1981. Cf. also Conti, 1965–1996b: 211 et seq., who posits for the Florentine *contado* relatively intense human occupation dating from the High Middle Ages.

49 See above, note 34.

50 Cf. Pinto, 1982: 41–67 and references contained there to the works of Conti, Fiumi, Cherubini, Herlihy and Klapisch, Giorgetti etc. and also the recent Piccinni, 1992 (for Sienese Tuscany).

51 As e.g. in Valdorcia (Ginatempo, 1990); among the former note e.g. the eastern part of the Volterra area (Ginatempo, 1995: 23–29).

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15. The Ottoman Imperial Registers: Central Greece and Northern Bulgaria in the 15th–19th century; the Demographic Development of Two Areas Compared

Machiel Kiel

The Ottoman Empire (1299 – 1918) was founded by the sword, as is well known, but it is less known that it was kept together by the pen. Unrealized by most historians, archaeologists or historical demographers of the south-east European lands, and particularly of Greece, and known only to a narrow circle of Orientalists, or better Ottomanists, the archives of the central bureaucracy of the Ottoman Empire contain an innumerable mass of detailed source materials for demographic or economic study, as well as for the study of political history and the history of culture of an area stretching from southern Slovakia to the Persian Gulf and southern Jordan. Especially for Greece this mass of sources is largely untapped.

The Ottomans began to organise a central bureaucracy under Sultan Bayezid I (1389 – 1402), describing their provinces one by one, village by village, household by household, together with a survey of agricultural production, of which 13% was taken as tithe and registration dues. They had inherited this system of land surveys from their predecessors, the Seljuks of Rum (11th – 13th century), who in turn learned the practice from the administrators of the great Abbasid empire of the classical Arab civilisation. Byzantine influence on the Ottoman system, as might have been expected, can hardly be detected: the Byzantines taxed the land, the Ottomans the products, and whilst the Ottomans only noted the heads of households, the Byzantines noted every individual up to the smallest child. A survey of the local measures for commodities as compared with the standard measures in Istanbul, precedes every well preserved provincial description, called *tahrir* in Ottoman/Arabic, enabling us to compute with a fair degree of exactness the total agricultural production per village, and from that level to the production per household[1].

The system of making *tahrirs* at regular intervals (20 – 30 years) and at every change of ruler was continued till the end of the 16th century. Parallel to the *tahrir*, registers were made for the poll tax of-non-Muslims, following the demographic data from the *tahrirs*. As those liable to pay poll tax had to have a certain amount of property, a group of fluctuating number is left out from the poll tax accounts, the poor, who were below the limit. The *tahrir*, on the other hand, has them all. After the 1590's the central bureaucracy set up a different system of counting the population, sending registration commissions into the field every few years, counting only the number of actual households but leaving out the poorest. Simultaneously registers were made for the "Extraordinary Taxes and Habitual Contributions," or in brief: *Avariz Defters*, also on a household base. This new system was changed in 1691, after which the poll tax was taken on the basis of the adult males, persons older than say 13–14 years[2].

Of every kind of register, *tahrir*, poll tax and *Avariz*, two different kinds were made, a detailed one (*mufassal*), containing every name, (and patronym), and a synoptic one (*Idjmal*) citing only the name of each village and the total number of tax units, as well as the tax revenue. Only in some isolated cases was the practice of making a *tahrir* continued. This was in circumstances when a new province was added to the empire (Crete 1670, Neuhausel/Novi Zamky in Slovakia 1663, or Kamenetz-Podolsk 1672), or when a province lost was retaken (Morea 1715, etc.) In some cases members of the imperial household acquired a number of villages or towns as a present from the Sultan, and turned them into *Vakf* property for pious foundations (mosques, schools, soup kitchens etc.) in Istanbul or in the provinces. In such cases also new *tahrirs* were made according to the old practice.

For the Greek lands a great many registers of all these three kinds are preserved. Due to the enormous amount of time needed to study them I myself could only analyze Athens and Attica, all of Boeotia, Eastern Thessaly (Pelion-Mavrovouni, including Larissa), the land around Delphi and Salona/Amphissa, and Acarnania. For the sake of comparison I also studied in detail the old Sandjak of Nikopol, containing most of Northern Bulgaria. All this has occupied me for 15 years.

The Turkish historians and a few Westerners who have worked with the Ottoman source material on population and settlement history, have a philological background,

and mostly not the slightest knowledge of demography or demographic history. Hence the numerous quite adventurous conclusions they come to, hence also their tenacious belief in the 'holy multiplier of five' individuals per household, valid for all centuries and all societies and social groups, once introduced by the founding father of this kind of study (Omer Lutfi Barkan). Characteristic is also the superstitious fear of using poll tax registers and *Avariz* accounts. In the case of the Poll tax the fear of unknown numbers of unregistered people in these registers means that they are little used. In the case of the *Avariz* defters the distrust rests on the belief that the names of households in fact represent tax units, "tax houses." This is indeed partially true. The misunderstanding, however, came into being when people used the synoptic *Avariz* defters, giving only the real number of tax units and not households ("village of X, 12.5 houses", or 'four and a quarter houses'). When, however, we take the detailed (*mufassal*) version of the *Avariz* defters, we see the enumeration of all real heads of households, then split into those who paid and those who were privileged not to, and afterwards the computation of the number of tax houses on the basis of the total number of those who had to pay. In the synoptic registers the group of privileged people, sometimes running up to half the population, is not mentioned at all. Only by identifying every single village of a district and putting the data concerning these places on a table, ordered by year of registration, can one see whether the numbers are reliable or not. At the same time, working on these lines, one gets a long term development, or at least the broad outlines of it. Because of the margin of inexactness we are only able to find the general outlines of demographic or economic processes, orders of magnitude. Not more. Yet in the total void of these so-called "dark ages" of Greek (or Bulgarian) history, between the end of the Byzantine/Frankish period and the early 19th century, there is a surprising mass of information.

The study of demographic history in the southern Balkans suffers from some other factors of a non-scientific nature. Without using Ottoman sources and almost only working along the lines of certain assumptions, some Greek scholars have concluded that, for example, the 16th century was the deepest point of Greek demographic development, the absolute nadir. Into this way of thinking fits the assumption that the city of Athens in the Ottoman period had sunk to the level of a "village", or at most a place without any significance. However, the Ottoman population records for the 15th and 16th century show in an irrefutable manner that Athens counted among the three or four largest cities of the entire Balkans, a Balkan Metropolis, ranking immediately after Edirne and Salonica, and long before other cities of fame such as Sofia, Skopje, Philippopol etc. It is also firmly believed that in the 15th and 16th century the Greek population fled from the plains to escape "Turkish oppression" and founded new villages high in the mountains, away from the Turkish landlords. For regions deep in the mountain wilderness of Sterea Ellas (Central Greece), for example Kravari, Agrafa, Lidoriki, the Ottoman records from 1455 onwards till the end of the 17th century show a much slower yearly rate of growth than the lowland villages of Boeotia or Thessaly. In this kind of work, ignorance and prejudice take the place of solid sources. In the case of Westerners, not suffering from the mentioned defects, scholars such as Peter Topping came to the wrong conclusions because they lacked vital information. In his otherwise excellent contribution to the Minnesota Messenia project (Topping, 1972) he did use the published Ottoman data of 1521 as provided by Barkan. His conclusion was that after 1521 the population of the Morea (Peloponnese) would hardly have expanded beyond the level attained then. As he could not make use of the late 16th century *tahrirs,* he was also unable to see the tremendous population growth in the Morea precisely in the years after 1520, a process in which the Moreot population more than doubled and in some cases trebled, preparing for the grave troubles in the area in the 17th century.

In contrast to Greece, Bulgarian historians and demographers have used Ottoman material extensively. They have a large collection of *Idjmal* (synoptic) poll tax registers and a group of fragments from torn or half destroyed *tahrirs* which were sold to Bulgaria as waste paper in the early 1930's. Yet Bulgarian research has suffered terribly from other non-scientific factors: masochism, the desire to depict themselves as the poor victim of "brutal Asian hordes," ethno-centrism and a government-dictated outline of history. Almost unanimously, Bulgarian researchers concluded (or had to conclude) that the notable decline in the numbers of Christians in the Bulgarian lands in the 17th century was the result of massive government-conducted campaigns of violent mass-Islamisation of the local Christian Bulgarians. The model of colonisation by groups of Ottoman Turks, held to be responsible for the total destruction of Bulgarian medieval cities and their subsequent re-settlement by Turkish colonists, was dear to Bulgarian historiography of the pre-war period. Then a large fragment of an Ottoman *idjmal tahrir* of 1479 was discovered, showing that the cities were still predominantly Christian/Bulgarian almost a century after the Ottoman conquest (1393). The new interpretation had to be that the Muslims in the Bulgarian towns and villages were not Turkish colonists but converted Bulgarians, who in course of time also lost their language. Thus in fact a tiny group of Turkish administrators and soldiers was supposed to have assimilated linguistically an overwhelming Bulgarian majority. In the 1970's this became the central point of party doctrine, culminating in the massive assimilation campaign of 1984/85, with the help of tanks, troops and helicopters. Thus with the model of colonisation denied and the decline of the 17th century only explained as the result of Islamisation, most works of the Bulgarian orientalists, with the exception of a very few, cannot be used. In fact the

Ottoman records show both colonisation and conversion, a very slow process, stretching over centuries. And they also show that in the 17th and early 18th century the Muslims in Bulgaria declined too.

This said, it will be appropriate to turn to the weaknesses of my own research. I had a training as a historian and as a historian of art, combined with a study of Ottoman Turkish language and literature. I had no formal training in historical demography, nor in archaeology or historical geography. The demographic data I offer here in the form of tables are alright from the philological point of view, but my interpretations might be open to discussion. In the following I will offer data on a district in Central Greece, which I could study in detail, the old Kaza of Talanda in eastern Locris; a survey of about half the population of the mountain district of Agrafa; details about the village of Kapourna, the successor of the ancient town of Glaphyra in eastern Thessaly; and for comparison two districts in Bulgaria. The last-named are the mountain canton of Zlatitsa, containing one small town and 15 villages, and the entire lowland Kaza of Hutalič Selvi, the modern Bulgarian Sevlievo, which contains one town, 28 villages with Slavic names and 14 villages with Turkish names.

The small polje of Zlatitsa lies at an altitude of almost 800m. above sea level and is surrounded by high mountains. Cereals are harvested a number of weeks later than elsewhere in Bulgaria, because the lower average temperature makes the harvest ripen much later. The Selvi district, on the other hand, is mostly an open plain of 200m. above sea level, surrounded by rolling lands and wooded hills. The land is fertile and has a higher yearly rainfall than the more eastern parts of northern Bulgaria. The district of Atalanti/Talanda, on the other hand, is stony, with a very limited amount suitable for agriculture. Throughout history it has been an area of marginal importance, staying outside the main events of history. Agrafa, which is said to have its name from Byzantine times, is largely a mountain wilderness, with small plots of arable land but with extensive stock breeding activity, especially sheep. In the early Ottoman tax system sheep (and goats) were taxed with one *akçe* per two head of sheep. In later centuries, when the *akçe* had lost much of its value, one, then two *akçe* were taken per one sheep, all mentioned in detail in the registers. The registers show that stock breeding was one of the main supports of the Agrafa village economy, as can be expected because of the nature of the land. I also studied in detail population and economy of the lowland plains of eastern Thessaly and of Boeotia. The data concerning these areas will be published elsewhere, with the Academy of Science in Göttingen and with John Bintliff in Durham. They will only partially be given here, but the conclusions based on the study of these areas are fully incorporated in this overview.

Although different as to landscape, both the Bulgarian and the Greek districts studied here had a particularly violent history in the Later Middle Ages. Northern Bulgaria had suffered terribly from recurrent Tatar raids carrying off a large part of the population. Besides that it suffered from the usual effects of the crisis of the 14th century. On top of this came the destructive Crusade of Varna (1444) and the murderous campaigns of the Valachian Voyvode Vlad the Impaler, the historical prototype of Count Dracula (1460's). Central Greece, Eastern Thessaly and Boeotia, Attica and the Levadia-Atalanti region, had suffered terribly from the Catalan invasion, the Albanian incursions (Thessaly) and especially the wars between Venice, the Florentine Dukes of Athens and Thebes, the Navarrese Grand Company and the Catalans. By the end of the 14th century the lowlands must have been largely empty, the Plague epidemics finishing off those who had survived. The oldest preserved Ottoman register for Northern Bulgaria, from 1479, shows us that one third of the settlements of earlier times were deserted and destroyed. The register mentions them because of their agricultural potential. We should bear in mind that the Ottoman conquest of Northern Bulgaria had been relatively peaceful, most cities and castles surrendering their keys before the siege started (1388/89 and 1393). It was in particular during the "Crusade of Varna", 1444, when most of Bulgaria's old cities were destroyed, its populations scattered or carried off en masse to Valachia (1462). The oldest preserved register for Thessaly (1455) shows that the great eastern plain must have been empty at the time the Ottomans arrived (1388/89). Remarks in the works of Marino Sanuto the Elder and by Archbishop Antonios of Larissa, both writing decades before the arrival of the first Ottoman, also point to this situation. The eastern plain had to be colonised by Turks from Western Asia Minor. The old village names point to the place of their origin: Aydinli, Menteseli, Germiyanli, Saruhanli, all provinces along the western coast of Asia Minor, or have tribal names such as Ugurlular, a people which is known to have lived in Western Asia Minor before they moved to Thessaly. At the same time other places, many with Slavic placenames (Nevoljane, Seliscane, Kukurava, Makrinitsa, Zagora, etc.) were revived by Greek settlers, presumably coming from the Western Plain and the mountainous hinterland of it, which had not suffered so much from depopulation, as the register evidently shows. Many villages in the eastern plain have the associated remark that they were newly founded and not in existence during the previous registration (c. 1425). The picture is very much the same in the plains of Boeotia. This area was annexed without great military upheaval in 1460. This oldest preserved census is from 1466. What we see in all the areas mentioned, in Greece as well as in Bulgaria, is that as soon as peace finally returned, and a strong order was established, combined with moderate taxes, the population of both countries started to grow with an astonishing speed. This recovery from the troubles of the 14th century is also noticeable in other European areas, and must have also had other reasons beside "law and order" brought by the Ottomans.

In the case of the Boeotian population we can conclude

that it more than quadrupled in just a century. In the case of the 16 villages of which I give the details per village, it tripled. This is, to the best of our knowledge, far above the known increase in other parts of Europe, and must reflect recuperation after the destructions of the past. There was plenty of fallow land available for young couples. In the less fertile Atalanti region, the population just more than doubled in the years between 1466 and 1570. In the Agrafa village, however, in Greek historiography supposed to be the area where the Greeks fled, deserting the plains, the population rose only slightly. We would do well here to adjust the theory to the practice, to the numbers made available by the Ottoman sources.

In the case of the Bulgarian districts studied here, the population of the Zlatitsa district more than trebled between 1479 and 1580. This was partly due to the inflow of Turkish colonists. The jump of 62 Muslim households in 1479, to 310 in 1516, is by all standards impossible to explain as the result of natural growth. An increase in the number of "newly founded" villages with Turkish place-names and Muslim inhabitants having very Turkish names (pre-Islamic names such as Suyakdi, Satilmis, Kutlumus, Dursun etc.) from two to six is also clear enough. At the same time the numbers of Christian inhabitants stagnated, not because of conversion to Islam, as there were no converts in the Muslim villages with Turkish placenames, as the register shows. Perhaps the influx of considerable groups of mobile, semi-nomadic Turkish cattle breeders had caused a shock in the Christian Bulgarian society of the Zlatitsa polje. It took some decades before they adjusted themselves to the new situation, the Ottoman government often helping the Christian villages by giving them a para-military status of Derbendji, or Guardians of the passes. After 1516 they started to grow again and after 1540 with full speed. At the same time, however, a slow and creeping process of Islamisation begins in the old Bulgarian villages. In 1540 there were 33 households of new converts to Islam in these villages. In 1580 their number stood at 99 households, in 1642 there were 175 households of them. Together with the rapid growth of the Turkish colonist population, this led to a rapid transformation of the religious structure of the canton, which in 1479 was 11% Muslim, but in 1642 had changed to a Muslim majority of 52%.

A very similar development took place in the fertile lowland district of Selvi/Sevlievo. The land was less destroyed than the Central Greek territories and there was less room for new Turkish colonist villages. There were only two of them in 1479, but 10 in 1516, and 15 in 1580. The population shows the same upward jump as in Zlatitsa. There were 27 converts to Islam in the Turkish colonist villages, or 4.7%, showing that this aspect in the colonist villages played hardly any role, although most of Bulgarian historiography has made a strong issue of there being no Turkish colonisation (without, however, having the sources used here at its disposal). The pattern of development of the Christian villages of the Selvi district, all having good Slavic names, shows a slight decline in the numbers of Christians between the years 1526 and 1540, precisely those years when the bulk of the Turkish colonists arrived. Then they see a rapid growth, but here the effect of Islamisation is slowly eroding the number of Christians. The number of Muslims in the old Bulgarian villages grew from 35 in 1479, to 85 in 1545. This could indicate that not all Muslims in the old Bulgarian villages were of convert origin. A number of them may have been Turkish settlers and their descendants. Be this as it may, at some date in the early 17th century the district of Selvi reached a Muslim majority, and kept it till around the mid 19th century (see graphs for Kaza Hutalič/Selvi).

My interpretation of all these numbers, in Greece as well as in Bulgaria, is that the population in these districts grew so rapidly precisely because they had "to catch up" to make good the losses of the pre-Ottoman period. In the former Yugoslav Macedonia, which I have also studied in detail, and which had not suffered at all from depopulation as in Greece and Bulgaria, populations in the 16th century hardly grew at all, or even declined slightly. This pattern is also valid for the south-western most parts of Bulgaria, which also had not or hardly suffered in the 14th-early 15th century. Here a special pattern of marriage is known to have existed for at least a century and a half, if not longer. A young boy of 17–18 years marries a girl of 28–30 years. In this manner about half of the children born in a 'normal' marriage do not come into the world, thereby effectively curtailing population growth. The girl in this pattern sleeps with her husband as well as with his father, standing between the two as to age, and in sentiments as well. Would we be allowed to project this curious, but effective pattern into earlier ages? In this context it should be said that the well-known Ottoman practice of Devshirme, Paidomazoma in Greek, of collecting young Christian boys for service in the palace and the army, hardly played any role in the demographic process. Two newly discovered Janissary Recruitment Registers in the Istanbul archives, from 1496 and from 1603, thus covering both the early and late classical phase of the empire's history, give a massive and detailed information on this practice. Only a half percent of the households in the visited provinces had to give a child, and their age, which is given in detail, including the names of both parents and the village of origin, ranged between an average of 14.5 in 1496 and 16.5 in 1603. Thus there is no "baby snatching" and no "breaking the backbone of the Christian population", so dear to Balkan historiography. They are 19th century legends. A few more recruitment registers can only further corroborate these findings.

My interpretation is thus: with plenty of land available, land which had laid fallow perhaps a century or more, population expanded rapidly. By 1570/80 it must have reached some sort of ceiling. Everywhere after 1570/80 populations begin to sink or to stagnate. In the hills of Eastern Thessaly the process started two decades later, but

it came all the same. By the mid 17th century the population of Locris-Atalanti had sunk to half the number of 1570. In 1688 the population of our 16 Boeotian villages also stood at half the number of 1570. The same happened in the Zlatitsa area, where the downward trend went on even deep into the 18th century. In Locris and in the villages of Boeotia the dramatic population rise had evidently eaten up the resources. Although the total output of cereals grew between 1506 and 1570, the number of kilogrammes available for each household rapidly fell. The rhythm of growth in Boeotia starts to slow down after 1521, and had almost stopped between 1540 and 1570. Cereal production had indeed grown but this was at the expense of the wine production, which declined. At the same time, it seems, the villagers tried to increase their numbers of sheep, which could be partially sold to obtain money to buy other essentials of life (for example olive oil, which was hardly produced in the area). At any rate the 1570 agricultural data seem to show that the Boeotian population was sinking to the level of subsistence. The same had happened in the mountain canton of Zlatitsa. In 1516 almost all peasants possessed a full farm, in 1580 only a quarter of them still had one and a whole class of landless peasants had come into being. On top of these difficulties came the "Little Ice Age" of the 17th century, hitting mountain areas particularly hard[3]. On top of that came a marked increase of taxes and all sorts of abuse, as after 1585 the Ottoman empire was slowly losing its grip on the provinces. In the Greek context it was particularly the very large villages, places such as Dauleia, Valtetsi or Kaprena, which declined dramatically. They had an economy which in particular rested on textile production and were much more vulnerable to changes in the economic structure. In the 17th century, it should not be forgotten, cheap English textiles started to penetrate the Ottoman Empire, pushing the expensive local products from the markets. For Dauleia we happily have additional information about its population. The well known travellers Jacob Spon and George Wheler give in the 1670's even less households than the Ottoman poll tax lists of 1642 and 1688! It took more than three centuries before Dauleia again reached the population number of the Suleimanic age. And the same is true for a number of other Boeotian and Locridan villages.

Different, however, was the development of the district of Selvi, much more fertile than Boeotia or Zlatitsa. The number of Christians had sunk slowly because of creeping Islamisation. The Muslims, on the other hand, increased slowly. The total loss of population in this area was only one quarter, and after the deepest point of the crisis, around 1640/50, even started to grow again. Zlatitsa, on the other hand, kept declining till the mid 18th century. The Boeotian villages in our sample of 16 also slowly recovered after the late 17th century. For the 18th and early 19th century the Ottoman archives contain another sort of sources, giving the broad outlines of the growth of entire districts, not of the individual villages. These are the third version of the Poll Tax and the *Avariz* Defters, which in the central bureaucratic offices were computed on the basis of the provincial registers, which do have village by village statistics. Yet most of the 18th century material in the Turkish archives is still unstudied, and even uncatalogued. The "third version" poll tax and *Avariz* registers of Greece and of Bulgaria do indeed show a slow but persistent rise in the total numbers, from the end of the 17th till the beginning of the 19th century. A bit of this material has even been published, by Bruce McGowan.

Taken all in all, the Ottoman materials discussed here briefly show a general outline of development which is not fundamentally different from that elsewhere in Europe, be it that the 16th century increase was more rapid, but the decline in the 17th century more severe too[4]. It seems to show that the Ottoman Empire in the 17th century, like the Chinese Empire in the 19th century, succumbed to its very success. The century and a half of the Pax Ottomanica, like Manchu China, had caused a structural overpopulation. With the troubles of the 17th century as an additional burden, the population collapsed, died, or more likely declined because of a much smaller family size. The 17th century sources do show a much lower frequency of brothers listed than the 16th century lists. Yet much more very detailed demographic research is needed to prove or reject this proposed smaller family size.

I hope to have made clear that a tremendous amount of source material still awaits the diligent demographer, who at the same time must be an Ottomanist (a combination rarely found). As said before, the numbers given by the Ottoman registers are reliable, but in the field of interpretation many issues remain open, especially my own hypotheses. The figures which follow provide data and illustrations for the preceding analysis.

NOTES

1 There is a growing literature on the nature, the possibilities and the shortcomings of the Ottoman sources on population and taxation, the *tahrir* registers. See for example Barkan, 1940, 1941, 1957; Inalcik, 1954 (reprint 1987); the article 'Daftar (Daftar-i Khakani)' in *Encyclopedia of Islam*, new edition; Mc Gowan, 1969; Beldiceanu-Steinherr and Beldiceanu, 1978 (with translation and facsimile of an original Ottoman instruction of how to make a census and also containing a list of actual census-takers); also Bryer and Lowry, 1986; Lowry, 1994; Kiel and Sauerwein, 1994.

2 For the Ottoman poll tax (djizje) and the 'extraordinary levies' (Avariz-i Divanije) and the registers on which they were based see Nedkoff, 1942; Hadzibegic 1952–53, 1955; the article 'Dzizya' in the *Encycl. of Islam*, second edit.; Káldy-Nagy, 1960; Hunyadi, 1980; Grozdanova, 1986 (warns of the fact that numerous groups of people, or whole settlements are not mentioned in the normal registers, having a special status); the article 'Awarid' in the *Encycl. of Islam*, new edition; Kiel, 1990; Darling, 1990.

3 For the noticeable lower average temperature in the 17th century and its effects on population and agricultural production see for example Arakawa, 1954; Lamb, 1972 (1977[2]); Le Roy

Ladurie, 1973; Parker, 1979; Wrigley and Farmer, 1981; Delano Smith and Parry, 1981; and finally the alpha and omega: Grove, 1988.

4 For the demographic history of the period see for example Mols, 1954–56; Postan, 1966; Helleiner, 1967; Russell, 1971; Mols 1974; Imhof, 1977; Asdrachas, 1977; Grigg, 1980; Herlihy, 1985; Kellenbenz, 1986; Kiel, 1992, 1991-92, 1993.

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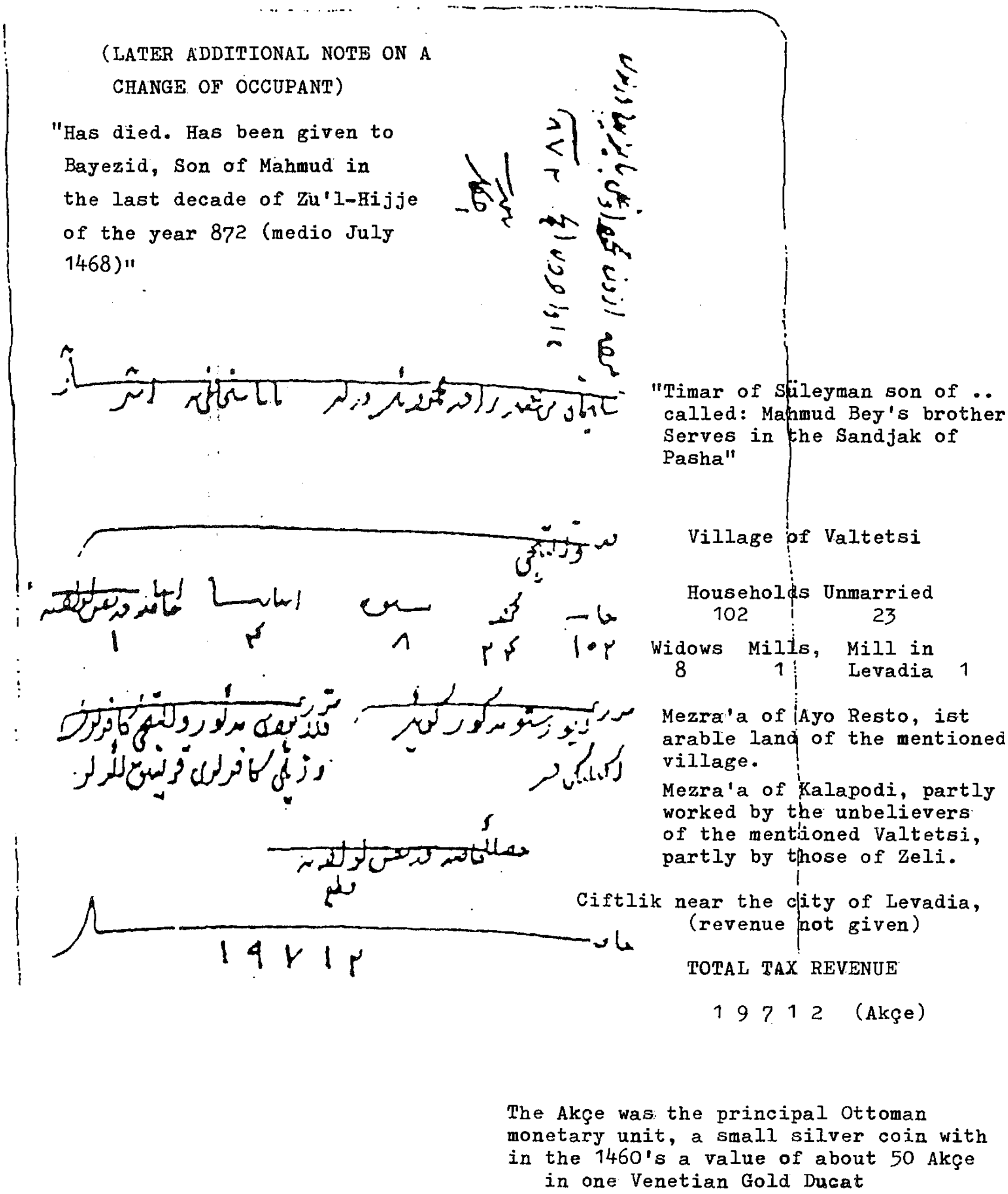


Figure 15.1. Kaza Talanda/Atalanti, East-Lokris, oldest Ottoman description of the (now disappeared) village of Valtetsi, 1466, and its modern successor Kalapodi, in 1466 still an uninhabited plot of arable land, worked by the villagers of the nearby villages of Valtesi and Zeli. (Mal.Mud. N° 66, p. 112).

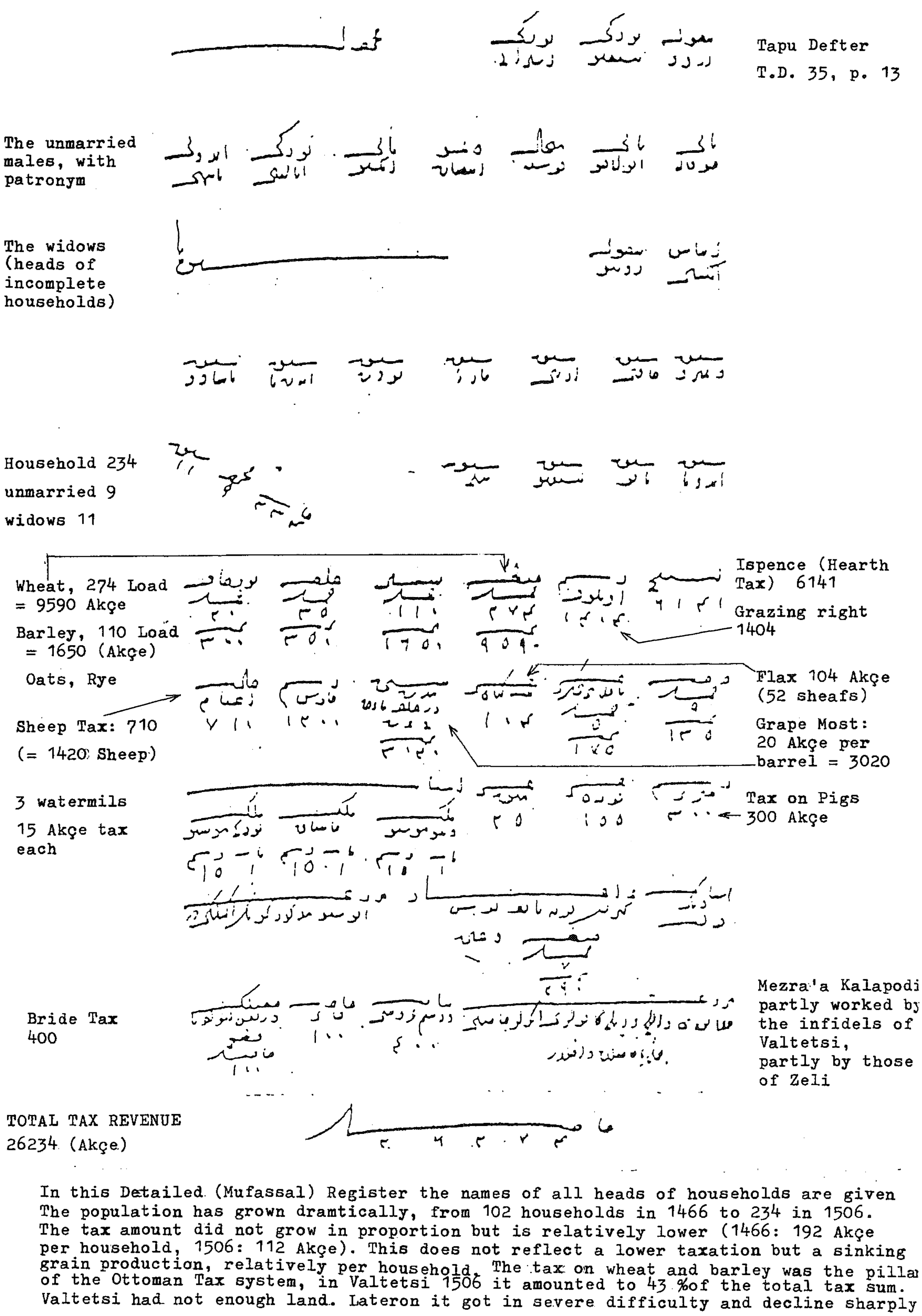


Figure 15.2. End of the detailed description of the village of Valtetsi in 1506.

Figure 15.3. The development of the population of the Kaza Talanda (Atalanti – Locris) 1466–1981 (for details see Figures 15.4 and 15.5, the Greek villages and the Albanian ones).

The Sources:		M.M 66	T.D. 35	T.D. 367	T.D. 431	KuK. 183	F.64 A a.e. 5	M.M. 561	M.M. 14823	Philip-pidis	Plit. Ellad.
Year of Registr.		1466	1506	1521	1540	1570	1616	1641/42	1688	1810	1879
ATALANTI	Musl.	/	13	37	42	52	?	(150)	(150)	300	/
	Christ.	248	449	434	459	633		399	350	300	305
AGNANDI		10	7	10	23	20	?	3	(3)	10	38
GARDINITSA		77	105	126	96	66	?	17	(15)	15	/
KALAMAKI		20	28	38	36	32	24	10	7	12	/
KAMARI		43	65	52	105	110	(30)	7	6	/	/
LEFTA		68	148	153	204	203	?	80	(60)	30	/
LONGOS		51	111	77	135	93	30	35	32	50	31
TAHTALI		119	258	119	255	216	?	56	(35)	15	20
VALTETSI	Christ.	102	234	270	352	307	?	40	(35)	20	/
	Muslims					13					
	Christ.	738	1405	1316	1707	1745		647	558	452	394
	Muslims		13	37	42	65		(150)	(180)	300	/
Total including 20% unregistered								810	700		
General Total (Households)		738	1418	1353	1749	1810		960	880	752	394

MK '95

Figure 15.4. The Greek villages of the Kaza of Talanda/Atalanti, explicitly mentioned in the source as 'Greek' (MK. '92/'95).

The Sources:	M.M. 66	T.D. 35	T.D. 367	T.D. 431	KuK. 183	F.64A a.e. 5	M.M. 561	M.M. 14823	Philip-pidis	Plit Ellad.
Year of Registr.	1466	1506	1521	1540	1570	1616	1642	1688	1810	1879
BOGDAN	32	(39)	40	45	42	23	10	10	25	/
BUZI	5	11	10	8	7	?	Mezraa	/	/	/
CHUBAVA	31	(19)	13	22	23	(22)	20	20	20	/
EXARCHOS	24	33	25	22	22	?	5	3	20	71
GOLEMI	/	29	34	52	54	27	10	6	10	32
KULAKA	47	(50)	52	62	76	(30)	23	7	20	37
LIKORES	31	(30)	33	32	21	?	4	2	/	/
LIVANATES	58	121	133	81	119	?	50	20	60	217
LUTSI (Andrea L.)	9	20	46	44	50	?	12	9	20	20
MAGULITSA	70	60	50	77	81	?	8	10	/	/
MALESINA	/	14	33	32	45	?	85	64	65	177
MARTIN MUZAK	13	46	77	63	75	(73)	72	100	300	280
MAZI	/	/	/	23	30	(32)	35	33	15	32
MONACHO	14	30	70	45	58	?	6	3	/	/
MUZAK-i Buzurg	/	11	33	21	16	?	Mezraa	17	/	/
NEOCHORI	14	10	15	20	30	?	11	(10)	10	/
PAPAVITSA	20	23	31	54	42	?	Mezraa	/	/	/
PAVLO (Muzak)	24	18	30	37	51	?	20	15	30	115
PROSKYNA	41	96	86	46	55	(53)	54	23	35	90
RADOS	18	24	34	22	45	(42)	40	36	15	/
TSARESI	45	(42)	39	42	55	14	5	2	15	/
VENDRE	11	15	42	19	23	(16)	10	8	/	/
VIRLOGOS (Vorlovos)	Mezraa	30	41	37	42	42	40	33	7	/
ZELI	53	50	58	76	75	?	100	(90)	50	94
TOTAL	560	821	1025	982	1137	620	620	521	717	1165
Total including 20% unregistered							(775)	(650)		

M.M. and T.D. = Maliyeden Müdevver and Tapu Defter, both in Başbakanlık Arşivi, Istanbul; KuK. = Kuyudu Kadime, in Tapu ve Kadastro Gen. Müd., Ankara; F.64 = Fond N° 64, Sofia National Library, Oriental Department. (M.K. 1992/1995)

Figure 15.5. The Albanian villages of the Kaza Talanda/Atalanti 1466–1879, explicitly mentioned in the sources as 'Albanian'. In households (all households are Christians).

Year of Registr.	Number of Inhabit.	Yearly percentage of growth	Inhabitants per Km² in Locris	Inhabitants per Km² of all Greeece
1466	6.000		6.7	
		1,46%		
1506	10.800		12,0	
		0,48%		
1521	11.600		12,9	
		0,68%		
1540	13.200		14,6	
		0,20%		
1570	14.000		15,5	
		negative		
1642	7.300		8,1	
		negative		
1688	6.900		7,7	
		0,22%		
1810	9.000		10,0	
		0,20%		
1871	10.162		11,3	29,0
		0,53%		
1879	10.601		11,8	33,5
		0,80%		
1889	11.482		12,7	34,4
		0,70%		
1896	12.060		13,4	38,3
		1,98%		
1907	14.963		16,6	41,6
		1,06%		
1920	17.162		19,0	39,5
		1,57%		
1928	19.438		21,6	48,0
		1,18%		
1940	22.379		24,8	56,8
		0,91%		
1951	24.737		27,2	57,8
		0,84%		
1961	26.917		29,8	63,6
		negative		
1971	26.873		29,8	66,5
		0,74%		
1981	28.938		32,1	73,8

Bases on the Sources as given on Table 1 and 2. With the pre-modern numbers a degree of incertainty has to be accepted, maybe 10 or 15% more or less, depending on the household multiplier taken (M.K. '92/'95).

Figure 15.6. The demographic development of the Atalanta district (East-Locris) 1466–1981 in total number of inhabitants.

POPULATION IN HOUSEHOLDS:

1466	37	1682	43
1506	90	1809	80
1521	122	1881	102
1540	91	1896	111
1570	97	1928	113
1643	56	1992	115

The ancient town of Glaphyra had a walled surface of c. 3 hectare. It might have had at its prime 500 inhabitants, or about 100 - 110 households.
The small 'polje' of Glaphyra has a surface of about 400 hectare arable land of mediocre quality.

TOTAL PRODUCTION OF WHEAT AND BARLEY OF THE ENTIRE VILLAGE:

1521	66,460 Kg.	=	545 Kg. per Household
1540	66,950 Kg.	=	736 Kg. " "
1570	61,540 Kg.	=	634 Kg. " "

CONCLUSION: Inelastic cereal production, not enough good land to expand.

ADDITIONAL PRODUCTION:

1521	9 barrels of wine per Hh.	11 Sheep per Household
1570	100 " " " " "	20 " " "

(M.K. '95.)

GENERAL CONCLUSION, in 1521 (and in Antiquity) this settlement reached the highest number of population that could live there, when living exclusively on agriculture. During the crisis of the 17th century Kapourna collapsed, it recovered at the end of the 18th century and remained since then more or less static at 400 - 500 inhab.

In 1992, according to the numbers made available by the village secretary, Mr. Konstantinos Koutoukis, the old polje of Glaphyra produced 536000 Kg. of wheat and barley together, or eight times more than in the 16th century. Much increased agricultural production methods must account for this difference. Besides the cereals the village produced in 1992 5,600 litres of grape must, 26,500 Kg. of almonds (which fetch high prices) and a small quantity of olives (totally lacking in the 16th century). On the other hand, the wine production of 1570 was very much higher and constituted the pillar of the village economy.

In 1992 71 families live entirely from agriculture, 44 other families lived partly from agriculture, partly from jobs in the nearby city of Volos. In 1992 5,760 Kg. of wheat was harvested per family, even more than the highest yields in the Atalanti/Talanda area (Lutsi 1506: 4242 Kg.; Pavlos 1506: 4277 Kg).

THOUGHT: As no more than 400-500 people can live in this area with such restricted agricultural possibilities, is this not also valid for greater areas?

Figure 15.7. The development of the village of Kapourna (Glaphyra) in Eastern Thessaly (between Volos and Lake Karla) 1466–1992.

	1455	1466	1506	1540	1570	1643	1815	1879/81
AGRAFA	3.2.7.	n.d.**	265	224	277	100	60	109
BEZA	-50-*	n.d.	70	89	98	60	10	30
BORTE	73	n.d.	69	65	89	56	40	-60-*
CHRYSOBO	276	n.d.	348	310	334	200	800	33
ELSANI	/	/	/	32 m.	33	32	10	51
GRANITSA	56	n.d.	45	-50-*	60	40	40	175
KARITSA	31	57	25	56	60	80	200	68
KASTANEA	45	n.d.	50	59	71	90	500	115
KERASOBO	229	n.d.	310	300	318	200	60	162
KERASEA	25	n.d.	30	44	55	50	40	43
KUMBURIANE	52	77	22	64	-70-*	76	50	70
KONIAVI	26	n.d.	11	17	15	-10-*	6	56
KLEISTON	190	228	200	176	182	120	80	178
LEONTITON	40	43	37	50	60	38	100	80
MONASTERAKI	76	n.d.	20	67	52	60	18	63
MIRYSI	2	n.d.	18	6	7	15	30	45
MUCHA	/	/	/	28 m.	33	18	20	12
PETRILON	121	182	165	145	149	208	1000	261
PALEOKATUNA	50	n.d.	57	69	66	-35-*		39
RENTINA	80	106	-110-*	114	125	48	400	305
SPINASA	23	59	75	-85-*	95	48	60	87
STONGOS	25	n.d.	-23-*	22	75	-20-*	35	50
TITAGI	53	n.d.	66	-75-*	124	84	40	30
VRANJANE	228	240	250	288	266	196	90	75
VULPI	/	/	/	-8-*	15	32	30	47
(M.K. '95)	2.078		2.266	2.475	2.739	1.908	3.729	2.244

* author's reconstruction
**n.d.: no data available

Represented on this table are about one third of the villages which according to W.M. Leake, *Travels*, belonged to Agrafa and about half of its total population.
According to many Greek and Western accounts the Ottomans never entered the Agrafa district because of its warli brave population. In fact they went to every village as early as the early 15th century and carried through a numbe and land registrations. The Tahrir of 1521 was not at my disposal when this table was made. Instead of receiving refugees from the lowlands, fleeing the "Turkish oppression" the population of Agrafa grew much slower than tha lowlands. (1455-1506: = 0,17%; 1506-1540: 0,27%; 1540-1570: 0,27%, 1643-185: 0,39%) (to be published in 1 Academy of Science at Göttingen, Lauer ed.).

Figure 15.8. The demographic development of the Kaza Agrafa, Central Thessaly, 1455–1881 (in households).

Number of villages			Number of households		Total Estimated Population	
1466	68	,,	2201	,,	10,000	Inhabitants
1506	75	,,	4998	,,	26,000	,,
1521	109	,,	6774		36,000	,,
1540	121	,,	8292	,,	43,000	,,
1570	127	,,	8573	,,	44,000	,,
In 1466 53 households of Muslims (= 2.4%), in 1570 331 Muslim households (= 3.8%)						

ECONOMIC ASPECTS

WHEAT AND BARLEY PRODUCTION			NUMBER OF SHEEP		TOTAL WINE PRODUCTION	
Total production in Kilogrammes		Kg. per household	Total number	per Househ.	Total litres	per Househ.
1506	11,915,533 Kg	2384 Kg	71,906	15	801,225 L.	160 L.
1540	14,335,772 ,,	1729 ,,	147,470	18	324,153 ,,	39 ,,
1570	14,046,804 ,,	1638 ,,	173,870	20	348,385 ,,	40 ,,

M.Kiel '95

Figure 15.9. The total development of the population of the territory of the ancient ethnos of Boeotia (the Ottoman Kazas Istife and partly Levadya).

	1466	1506	1570	1642	1688	1800	1879	1896
AYA MARINA	33	30	130	35	30	40	100	120
AYO DIMITRI	55	107	85	30	30	40	70	130
CHOSTIA	14	36	49	40	30	60	70	198
DAULEIA	150	220	366	85	79	120	250	351
DISTOMON	/	10	40	27	28	150	262	236
EXARCHO	24	33	22	5	3	20	64	82
GRANITSA	23	27	60	120	80	40	84	182
KAKOS	12	30	45	100	80	75	83	130
KAPRENA (Chaironea)	134	145	289	80	77	30	61	66
KYRIAKI	28	24	204	120	100	(150)	215	221
KIVERI	6	(10)	16	30	25	15	13	15
KUTUMULA	24	11	25	30	30	40	79	110
BESKENI	46	43	46	15	15	30	(80)	100
STEVENIKO	35	(75)	130	56	50	100	101	118
SURPI	/	12	46	70	70	80	35	34
ZERIKI	/	15	38	15	15	30	102	118
TOTALS	584	828	1591	858	742	1020	1669	2231

M.Kiel '92/'95.

Figure 15.10. The demographic development of Boeotia in the 15th–16th century, during the crisis of the 17th century and during the periods of recovery in the subsequent period as reflected in the numbers of households of 16 Boeotian villages.

District of Zlatitsa (Central Bulgaria) the Turkish village of Tursunca in 1516.

Tursunca was a newly founded Turkish colonist village. It had 29 Households and 24 unmarried young men (= 45 %). This points to a young and rapidly growing population.

Tursun, the village founder, had 4 sons and 7 grandsons. To the other founding fathers belonged Kara Yusuf, with 6 sons, Mustafa with one son, Balaban with 2 sons and Atmaca with 5 sons.

From these founding fathers only Kara Yusuf was still alive. Two of his sons were married, four still unmarried.

The sons continued the pattern of reproduction of their fathers. Mürüvvet, the oldest son of Tursun, had four sons of which one was the Imam of the village. Musa, son of Mustafa had also four sons, all unmarried, etc.

From this we might conclude that the village of Tursunca was founded one or two decades before the year of registration.

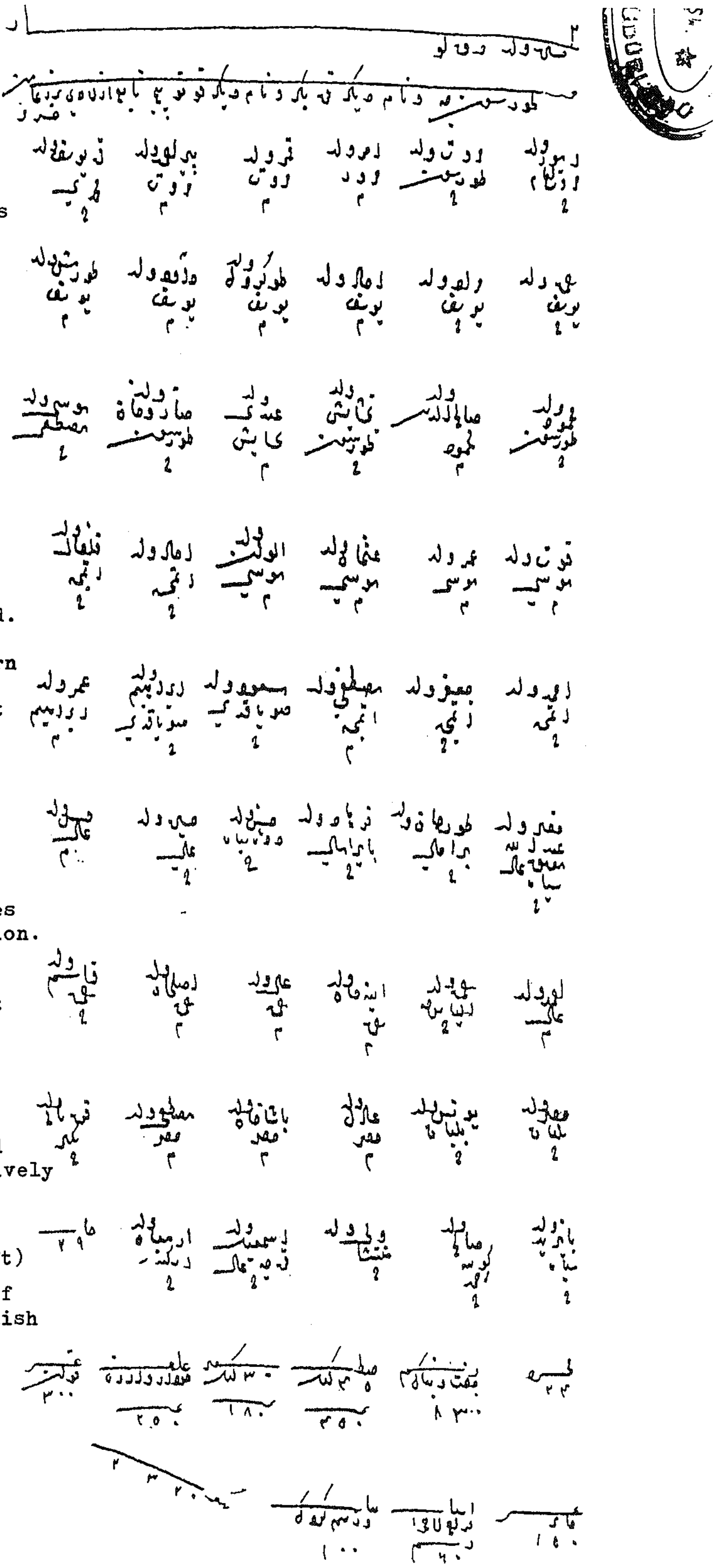
It should be stressed that there is not a single convert to Islam in this village, thus someone from Bulgarian/Christian origin.

With a cereal production of more than 3 tonnes (wheat and barley) Tursunca was a relatively prosperous village

In 1516 almost all Zlatitsa peasants had a full farm (Çift)

In 1580, after a rapid rise of the population, in the 6 Turkish colonist villages, only 215 from the 638 households had a full farm, 362 had half a farm and 61 were small crofters with hardly any land.

During the crisis of the 17th century Tursunca declined rapidly.



M.K.'95

Figure 15.11. District of Zlatitsa (Central Bulgaria), the Turkish village of Tursuna in 1516.

SOURCES	T.Iz. II		M.M. 11		T.D.416		T.D.718		T.D.775		MM.15198	MM.2846		Sâlnâme T.	
YEAR OF REGIS.	1479		1516		1540		1580		1642		1651	1752		1873	
KIND OF GROUP	Musl.	Chr.	Musl.	Chr.	Musl.	Chr.	Musl.	Chr.	Musl.	Chr.	CHRIST.	Musl.	Chr.	Musl.	Chr.
BUNOVO	3	24	3	34	2	35	2	104	0	70	82	0	15	4	1
ČELOPEK	0	89	3	86	3	76	17	142	22	100	120	13	63	45	132
DUŠANTSI	0	77	1	64	5	70	10	76	25	77	105	47	7	62	37
KALANLAR	29	0	86	0	125	0	187	0	79	1	1	54	1	115	48
KAMERLI BALA	0	0	35	0	37	0	54	0	20	0	6	10	21	36	24
KAMERLI ZIR	0	0	51	0	46	0	100	0	47	0	0	36	0	3	120
KARLI OBASI	8	0	28	0	35	0	46	0	28	0	0	4	0	33	8
KILISE KÖY	0	0	0	0	0	0	0	0	14	14	16	24	1	40	0
LĂDŽENE	4	34	6	45	9	60	20	87	62	12	6	52	0	144	0
MIRKOVO	0	90	4	71	5	87	29	104	49	36	50	48	31	161	209
PIRDOP	0	86	4	113	5	140	7	222	5	52	71	14	37	79	176
SMOLSKA	0	52	0	20	0	31	0	109	0	35	42	0	23	9	142
STRIČLO	0	20	0	25	0	30	3	36	0	28	34	0	29	0	96
TRAKAN	0	17	2	11	4	14	11	20	0	0	0	0	0	0	0
TURSUNCA	0	0	29	0	37	0	75	0	45	0	7	22	0	0	0
PAŞA YIĞIT	18	0	58	0	90	0	176	0	75	0	5	91	0	436	111
TOTALS	62	489	310	469	403	543	737	900	471	425	645	415	228	1167	1104
TOT. HOUSEH.	551		779		946		1637		896			643		2271	
Percentage of Muslims	11%		40%		42%		45%		52%			65%		51%	

(Paşa Yiğit = ZLATITSA)

M.K. '94.

Figure 15.12. The development of the Kaza of Izladi/Zlatitsa 1479–1873.

N° of source	I	II	III	IV	V	VI	VII	VIII
year of registration	1479	1516	1545	1580	1642	1751	1845	1873
	M. Chr.	M. Chr.	M. Chr.	M. Chr.	M. Chr.	M. Chr.	M. Chr.	M. Chr.
ADILLER (Idilovo)	/	39 /	31^{2} /	61^{7} /	47^{1} /	24^{3} /	45 /	64 /
ALI FAKIHLAR	22 /	17 /	27 /	68^{3} /	43 /	"Mezraa"	/	/
AKINCILAR	/	11 /	13 /	31^{1} /	20^{1} /	45^{2}	47	48 /
(Petko Slavejkov)								
ÇADIRLI-i BALA	14 /	35 /	36 /	66^{3} /	74^{2} /	85^{6} /	140 /	182 /
(Sennik)								
CADIRLI-i ZIR	/	10 /	10^{1} /	18 /	17 /	"Mezraa"	/	/
DERELI	/	8 /	6 /	30 /	38^{1} /	115^{8} /	114 /	125 /
(Gorna Rosica)								
DIKENLER	/	36 /	60^{3} /	27^{1} /	/	/	/	/
HADIMLAR	/	/	/	25^{1} /	23^{3} /	28^{1} /	65 /	93 /
(Adamovo/Jantra)								
HISAR BEYLI	"Mezraa"	6 /	20 /	26 /	25^{1} /	21 /	45 /	63 /
(Javorec)								
MALKOÇLAR (Burja)	/	28 /	30^{1} /	54^{3} /	81^{1} /	51^{8} /	150 /	190 /
MANENLI	/	/	/	19^{4} 2	19^{5} /	"Mezraa"	/	/
MUMCILAR	/	/	/	13 /	3 5	"Mezraa"	/	/
NAKIŞLI	/	/	/	46 /	18 /	"Mezraa"	/	/
RAHOVA	/	/	/	41^{1} /	47^{2} /	56 /	136 /	157 /
SELVI (Sevlievo)	/	18 /	20^{5} /	44^{3} 5	57^{6} 12	260^{15} 41	437 479	551 668
TOTAL	36 /	208 /	253^{12} /	569^{27} 5	512^{23} 12	685^{43} 41	1043 479	1316 668
Percentage of Converts	?		4.7%	4.7%	4.5%	6%	?	?
% of Muslims	100%	100%	100%	99.5%	97%	94%	69%	66%

M. = Muslim; Chr. = Christian; HISAR BEYLI = Original Placename; (Javorec) = Modern Bulgarian Placename (most after 1934); the small numbers above the number of Households is the number of converts in that year;

Sources: I = Sofia, OAK 45/29 (Turski Izvori II); II = Istanbul, BBA, MM 11; III = Istanbul, BBA, TD 416; IV = Ankara, TKGM, KuK 58; V = Ist. BBA, TD 775; VI = Ist. Kepeci-Mevkufat 2913; VII = Ist. BBA, Temettüat Defterleri leri; VIII = Salname-i Vilâyet-i Tuna, 6, 1290. (M. Kiel, 1993)

* In 1580 Rahova is explicitly mentioned as a new village, which had split off from the village of Dikenler, which indeed shows a sharp decline. Rahova can be the site of a deserted medieval Bulgarian village. Hence its Slavic name in spite of its purely Muslim-Turkish inhabitants.

Figure 15.13. The demographic development of the 13 Muslim villages with Turkish placenames in the Kaza of Hutalič/Selvi (Sevlievo) 1479–1873 (in Households).*

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV
	1479	1516	1545	1580	1600	1618	1625	1638	1642	1644	1650	1751	1845	1873
	M. Ch.	M. Ch.	M. Ch.	M. Ch.	Ch.	Ch.	Ch.	Ch.	M. Ch.	Ch.	Ch.	M. Ch.	M. Ch.	M. Ch.
SERBE (Malki Văršets)	6 1	18 /	20^{2} /	22^{4} /	/	/	/	/	37^{2} /	/	/	28^{2} /	41 /	48 41
SOPOT	/ 41	1 39	/ 35	/ 53	82	52	40	20	/ 10	9	9	23^{3} /	25 /	27 /
TERČOVO /Doganci/	/ 25	/ 22	2 20	5^{1} 16	25	13	19	11	20^{2} 10	10	10	30^{3} /	65 /	82 /
VRABEVO "Rabyon"	/ 69	/ 80	/ 120	29^{2} 104	158	42	99	50	41^{4} 10	10	8	59^{6} 2	135 /	158 /
YENIKÖY /Novo Selo/	/	/	/	/	/	/	/	/	/	/	/	/ 64	/ 128	/ 704
TOTAL	35 909	72 999	85^{23} 972	275^{36} 1416	1405	868	925	617	580^{102} 654	646	680	716^{55} 525	1216 1603	1465 2769
% Muslim of total populat.	3.7%	6.7%	8%	16%					47%			58%	43%	34%
		21%	27%	13%					17%			7.7%		

SERBE = old placename; (Malki Văršets) = Modern Bulgarian Name; M. = Muslims; Ch. = Christians; The small numbers above the number of households is the number of converts in that year and place.
Sources: I - IV, as foregoing; V = Istanbul, BBA, MM 14920; VI = Sofia, OAK 89/57; VII = Istanbul MM 1466; VIII = Sofia, F 179/185; IX = Istanbul, TD 775; X= Sofia OAK 93/26; XI = Sofia NPTA XVII, 5/22; XII-XIV at foregoing table
M.Kiel, 1993.

Figure 15.14. The old Bulgarian villages of the Kaza of Hutalič/Selvi (continued).

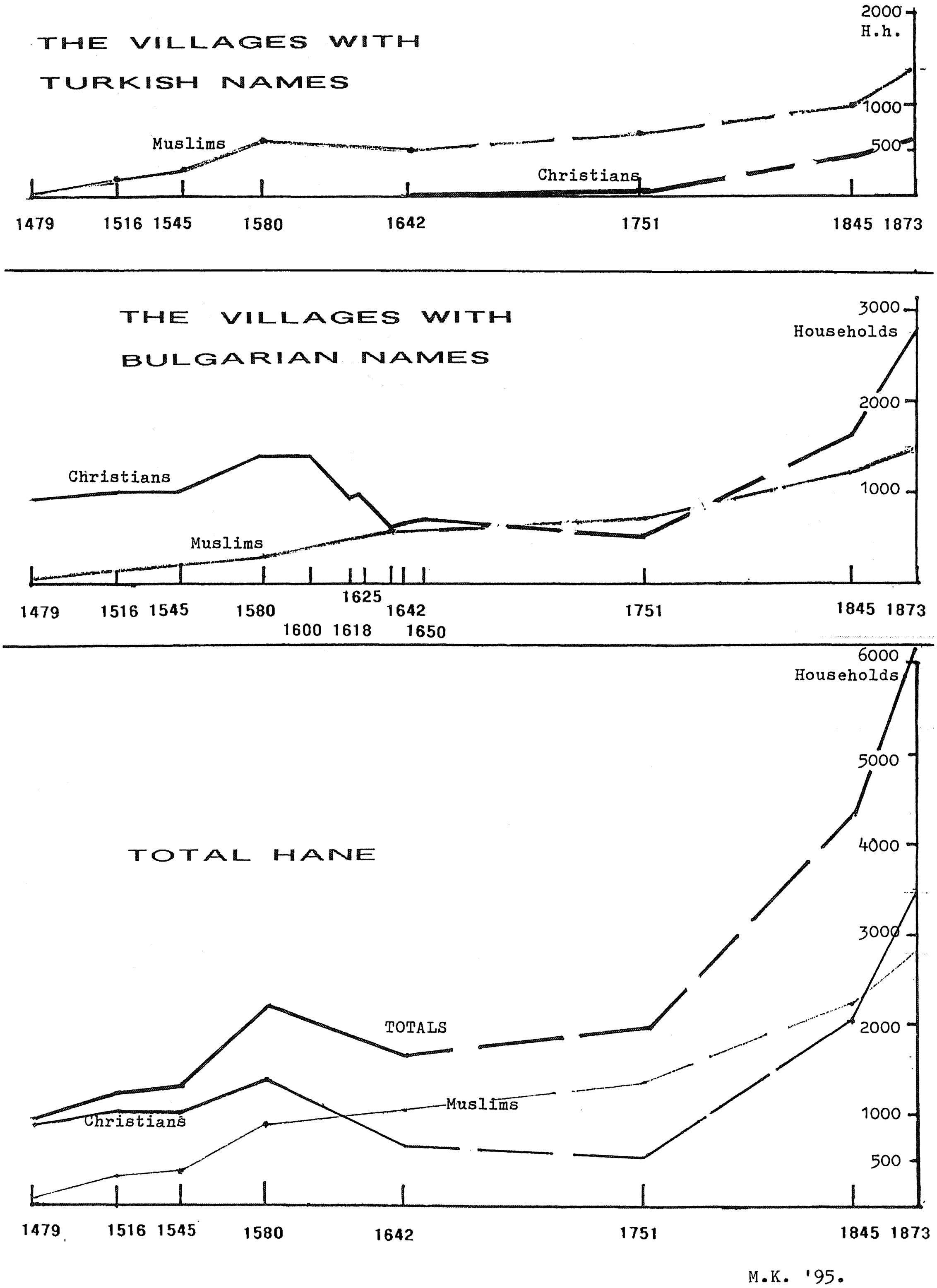


Figure 15.15. Kaza Hutalič/Selvi.

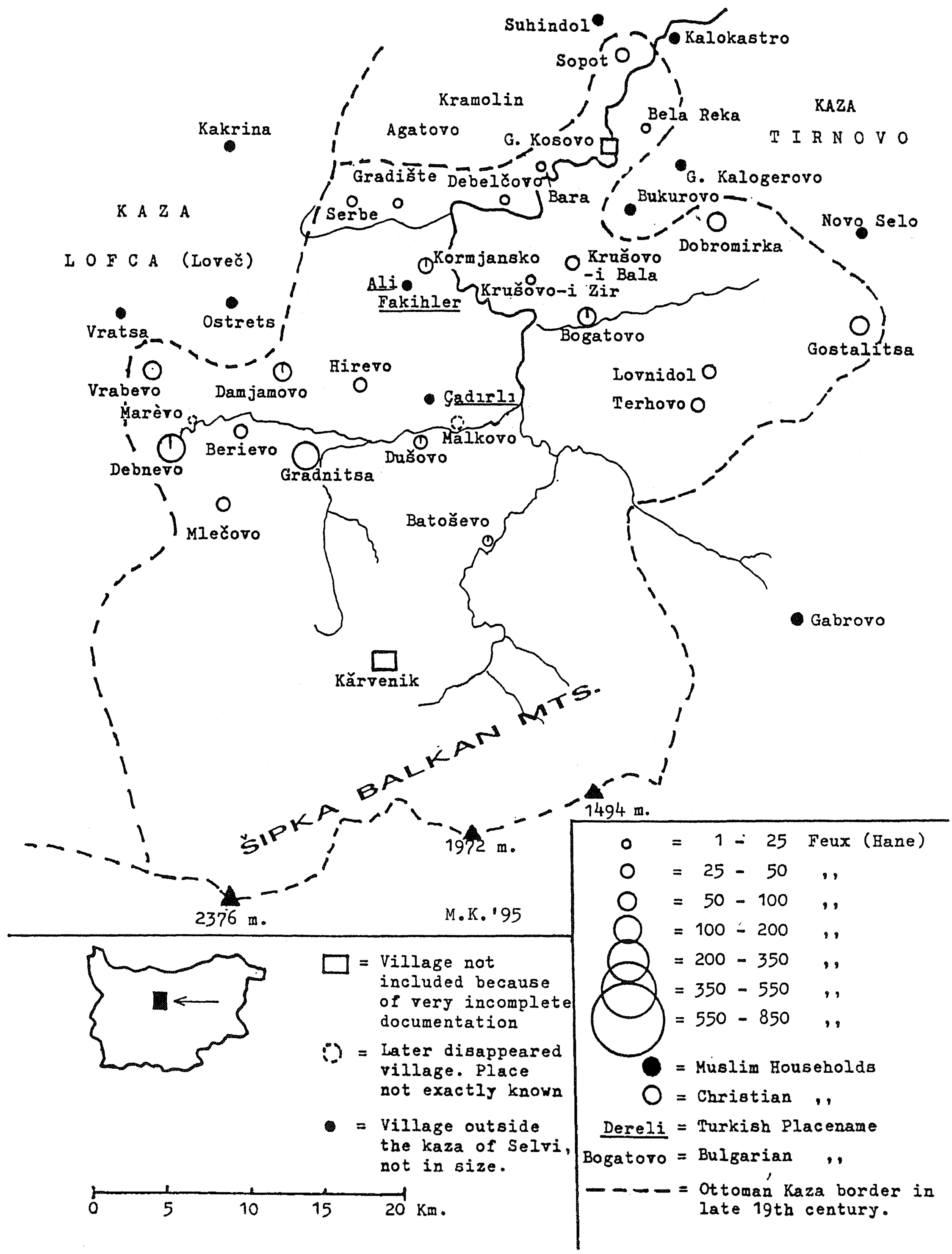


Figure 15.16. The Kaza Hutaliç/Selvi (Sevlievo) in 1479. Pattern of settlement, size and composition of the population.

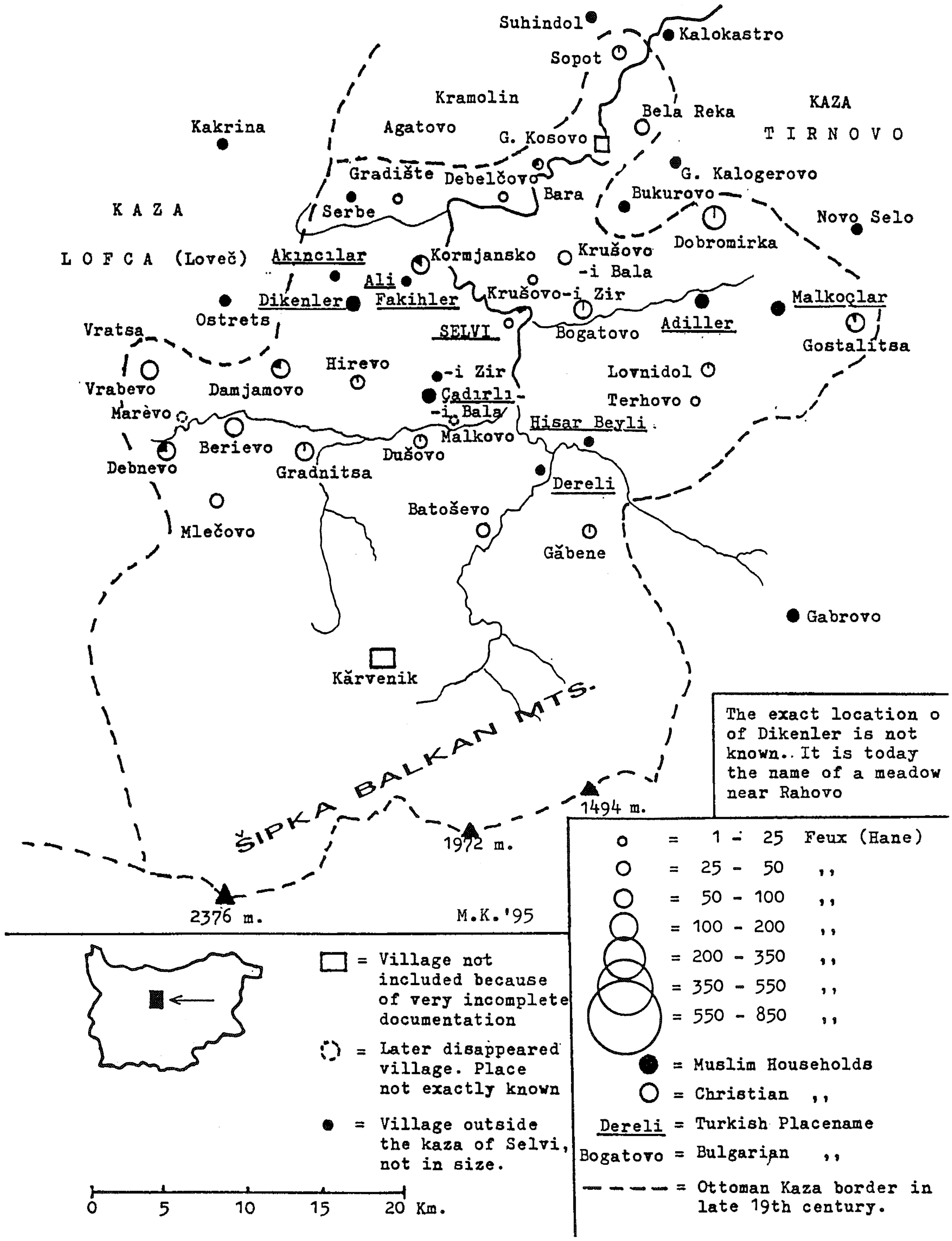


Figure 15.17. The Kaza Hutalič/Selvi (Sevlievo) in 1516. Pattern of settlement, size and composition of the population.

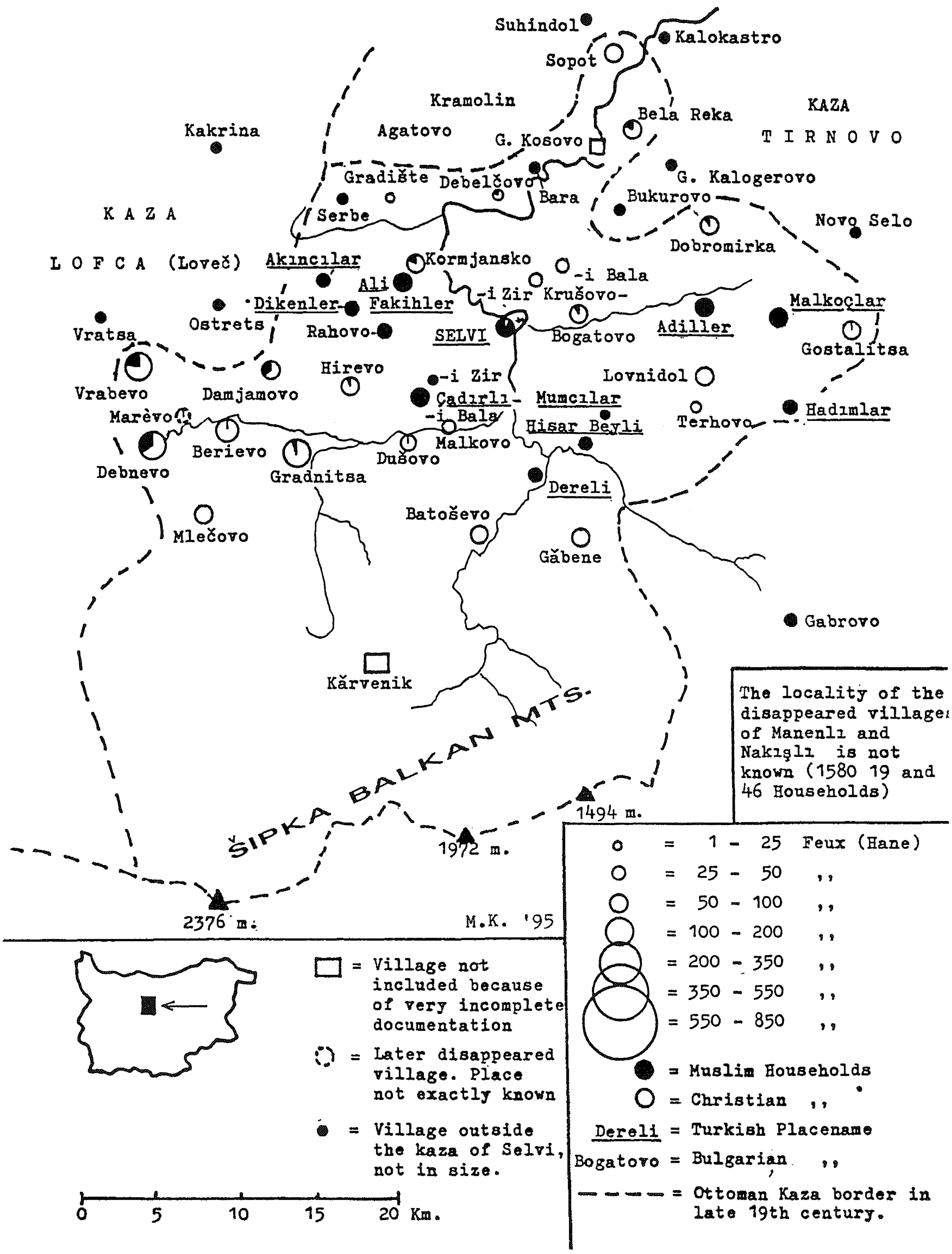


Figure 15.18. The Kaza Hutalič/Selvi (Sevlievo) in 1580. Pattern of settlement, size and composition of the population.

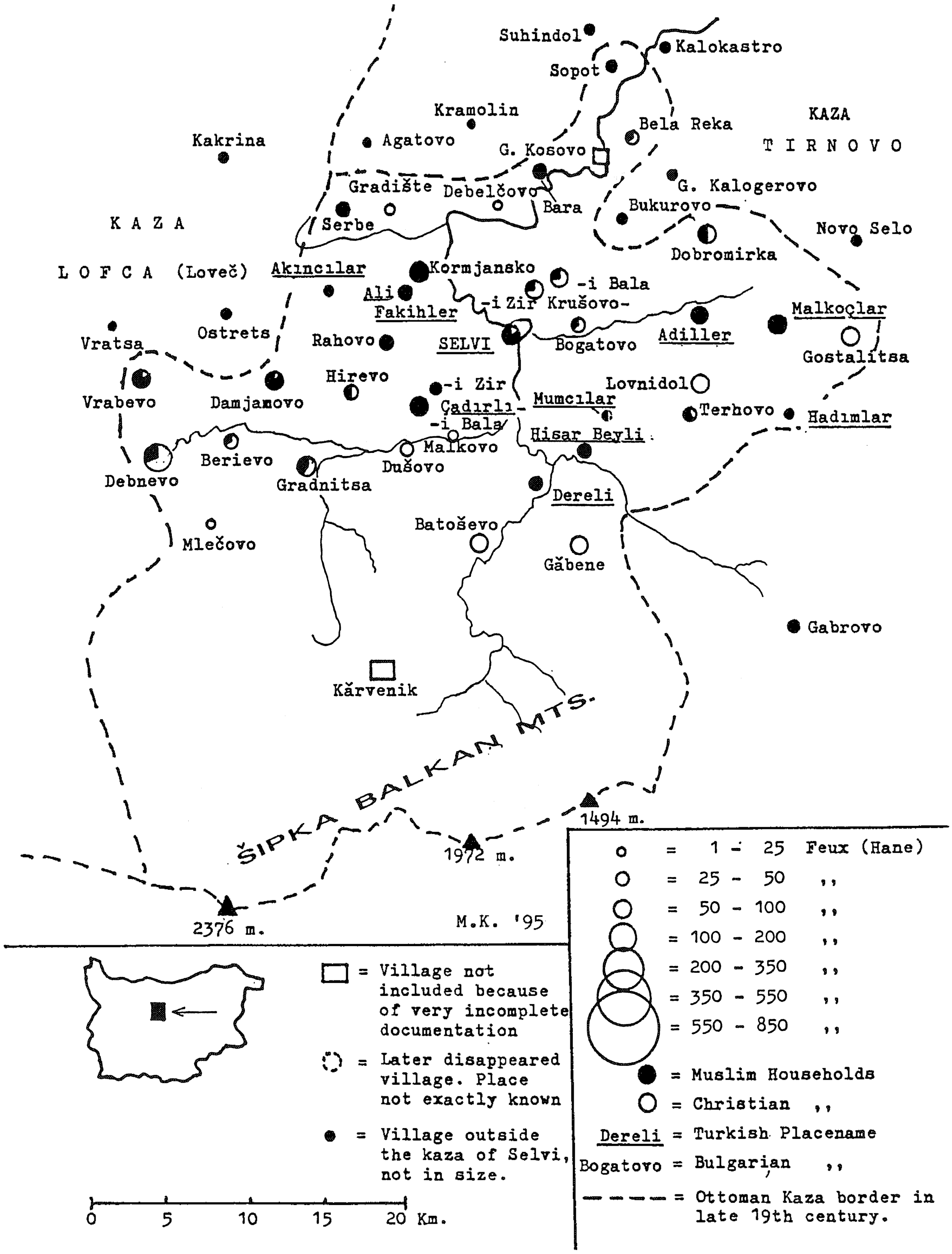


Figure 15.19. The Kaza Hutalič/Selvi (Sevlievo) in 1642. Pattern of settlement, size and composition of the population.

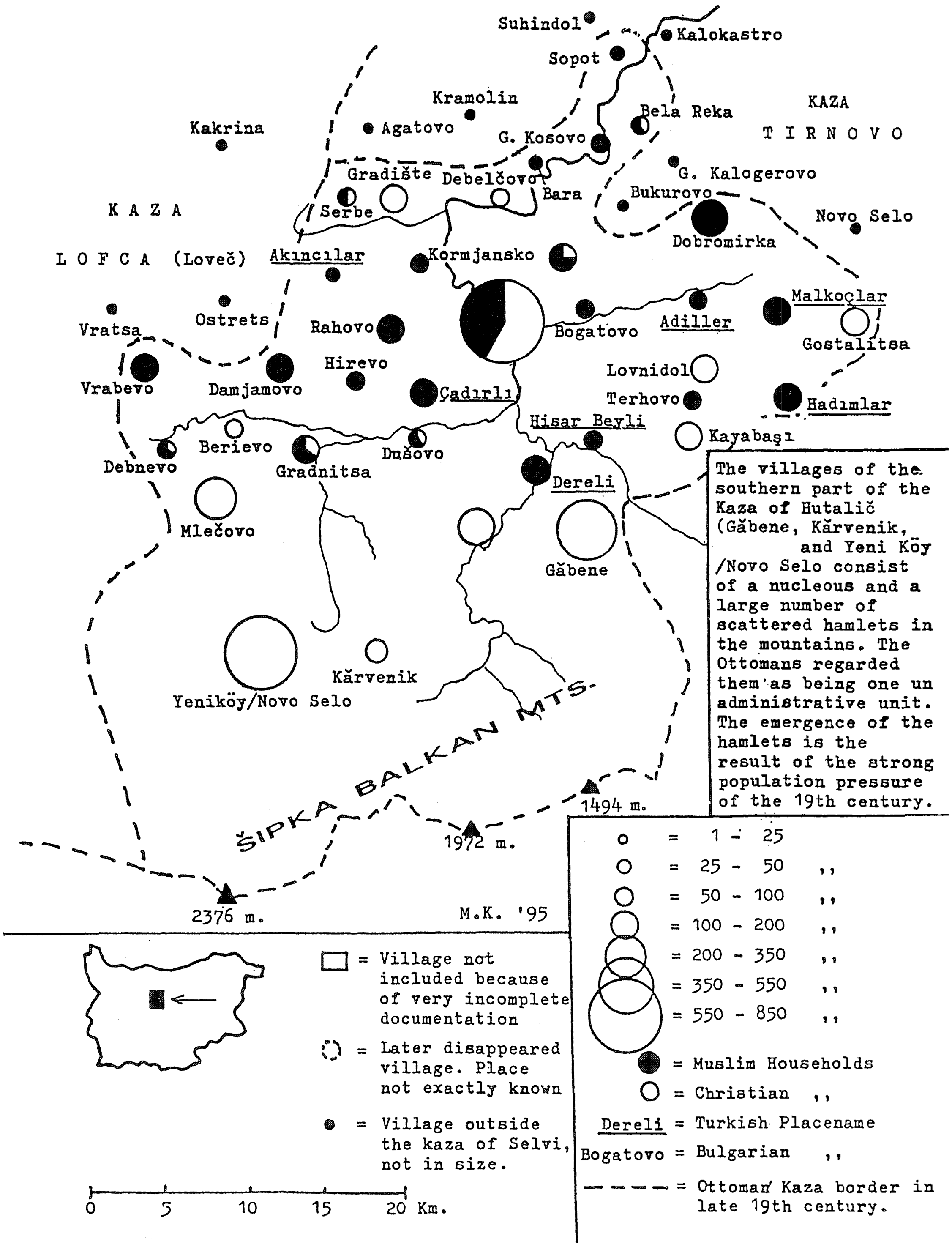


Figure 15.20. The Kaza Hutalič/Selvi (Sevlievo) in 1873. Pattern of settlement, size and composition of the population.

16. Investigating the Interface between Regional Survey, Historical Demography and Paleodemography

Kostas Sbonias

INTRODUCTION

Classic demographic analysis starts with the static description of the size, distribution and composition of a human population on the one hand and of the change in its demographic components across time on the other. Fertility, mortality and migration are the major demographic components, whose dynamic interaction forms the population level at any particular interval of time. Change in the equilibrium of these formative elements results in population dynamics. Modern demography has invented a series of methods to measure the spatial and temporal variations of these variables. National censuses and vital statistic registrations provide the data to relate the number of deaths, births etc. to a unit of population at a particular interval of time.

In respect of past populations, the problem arises with the fact that these demographic components cannot be observed directly and have to be inferred from other kinds of data, such as historical sources, parish registers, archaeological material, skeletal data etc. An interdisciplinary approach bringing together in a critical way information from all these sources is essential, in order to evaluate the shortcomings and biasses and achieve a reconstruction of the demographic characteristics. A series of questions can be asked:

- What kinds of data are available from each source and what is the grade of their reliability?
- As the link with demography is often indirect, we must understand the relationship between demographic conditions and the data upon which our demographic reconstruction draws, such as settlement patterns, family structures, land use, burial practices, skeletal data etc.
- What are the analytical issues that each source has handled, is this information in a static form, e.g. a figure of population, or does it reconstruct the dynamic interplay between demographic variables?
- Within the dynamic component of demography, different cycles operate with a different impact across time. How does the evidence from each source relate to these different levels?
- If we consider the dissimilarity and degree of detail of our data, for example crude information on the magnitude of past population density by surveys, information on specific cemetery populations by a paleodemographic approach, detailed information down to the individual level from historical demography, the different time-scales, as well as the general problem of relating historical to archaeological information, can we be optimistic for the comparative study of these data?

In this paper it is not possible to present in detail the methodological problems and approaches of each source, something that is beyond my competence, and I hope is covered by other specialist contributions. What I would like to do is ask some questions in respect of i) how information from the different sources meets and complements each other, contributing to the understanding of the regional demographic condition, and ii) from a methodological point of view, how a cooperation between the sources can help evaluate and overcome existing biasses. In doing so I will move through two successive levels of analysis: aggregate populations and vital events.

AGGREGATE POPULATIONS

At the level of aggregate population analysis, the evidence is in the form of overall figures. This doesn't evaluate population structure and demographic variables, but attempts the calculation of the population for a region or area, giving through comparison of population estimates of different periods or regions, broader information on long term aspects of population size and growth.

Information at this level is available from most of our sources (archaeology, ancient sources, historical demography) in different grades of detail and reliability. Surveys with their regional and multi-period aspect, and com-

parative survey studies bringing together information for larger areas (cf. for example Patterson, 1987; Barker and Lloyd, 1991; Alcock, 1993, 1994; Bintliff, 1997, b) are a strong source of information for such overall pictures. Labour intensive historical demographic work on the other hand, based on family reconstitution techniques and emphasizing rather the individual and localised aspect, makes the study of the absolute population size of larger areas difficult. More useful for later historical periods are population enumerations carried out by the authorities to assess the size of local or regional population. Estimation of the total population on the basis of graves and number of cemeteries might not be too helpful, as doubts can exist on the proportion of population buried (see for example Morris's arguments on whether increased grave numbers in C8th BC Attica, on which assumptions for rapid population growth are based, might actually be linked with a change in the proportion of population receiving a formal burial; Morris, 1987). Besides, cemeteries are not easily found by surveys, as it is on qualitative criteria that their identification relies (fine pottery, concentrated in small numbers) and not on overall densities. Discussion in ancient demography at the level of population statistics is based on the abundant information from the ancient sources on the population size of towns, areas, size of military forces, citizen size, men of military age, catalogues of ephebes etc. (cf. Beloch, 1886; Gomme, 1933; Brunt, 1971; Salmon, 1974; Hansen, 1986).

Usually comparative study of the information gained after critical evaluation of the different sources, takes the form of tables juxtaposing figures. The different level of detail that is considered as noteworthy by the different disciplines illustrates the difficulties faced by such comparative attempts. The differences can be seen very well in the discussion about the population size of ancient cities. Discussion of the ancient sources and estimation of the population size takes place at a great level of detail, for example trying to estimate for Classical Athens exact percentages of male citizen adults, young Athenians trained as ephebes, numbers of thetes, slaves, mercenaries, army and naval strengths, numbers of citizens migrating, or killed in battles (see Gomme, 1933; Ruschenbusch, 1984; Hansen, 1986). In archaeology the figure is estimated in a crude way, accepting a percentage of the town area available as domestic space and a population density, e.g. 225 persons per ha (Bintliff, 1997, a; Jameson et al., 1994: 551 table B.3). Considering the methodological problems and bias factors that all these attempts have to face, how do they contribute in establishing a credible pattern?

Contribution of surveys

In respect of surveys, apart from errors caused by the variation of the population density per square metre (Wilkinson, this volume), errors result also for rural sites whose size is estimated solely on the basis of surface evidence, as site size, especially for multi-component sites, is subject to visibility and taphonomic factors, and often its proportion revealed on the surface varies considerably from year to year. From the point of view of the ancient historian such archaeological estimates can be considered as unhelpful. Yet methodologies have been developed by field archaeologists to cope with these biasses, for example visibility correction factors to control surface vegetation and geomorphology (Bintliff and Snodgrass, 1985; Gaffney, Bintliff and Slapsak, 1991; Terrenato and Ammerman, 1996), recurrent survey of the same sites under different cultivation and climatic conditions (Barker and Symonds, 1984: 287–288), detailed geomorphologic studies and reconstruction of the erosional history and soil formation processes of a region (Cherry et al., 1988; Wells, Runnels and Zangger, 1990), breakdown of the site surface material by period and plotting of its distribution with GIS, to assess the formation process of the surface record and evaluate period by period site size (Gillings and Sbonias, in press).

The relative scale of the density of rural and urban populations derived from surveys certainly won't answer the questions of ancient historians on specific population groups, and it can't be related to short term events that historical sources mention, such as wars, diseases etc., unless they have a wider temporal and geographical impact. But it can be useful in terms of one of the main criticisms against the use of ancient sources: the difficulty of evaluating population figures or descriptions given by a variety of ancient sources, as they are subject not only to class, urban and other commemoration biasses, but also to the use of population growth or decline as common rhetorical themes not always related to genuine demographic situations (Duncan-Jones, 1980; Hopkins, 1987; Parkin, 1992: 4–17; Alcock, 1993: 24–32). General trends revealed by regional surveys can be used as a foundation for the evaluation of such historical sources, assessing the credibility of the figures mentioned within a regional and temporal framework.

Furthermore, regional survey results could help evaluate the size of our sample and define the boundaries of the populations we are studying, a difficulty inherent in both ancient sources and cemetery studies. This is important, as populations with vaguely defined boundaries obscure the real significance of the demographic phenomena we are observing. Is for example what is mentioned or observed a small scale phenomenon in a particular village, cemetery or population class, or is it a general or long-standing condition with a wider impact? Many cemetery studies can't answer such questions as they lack a regional approach, whilst historical demographic work based on ancient sources is often dependent on the biasses of the ancient authors. The well-known passage from Polybius for example on the massive depopulation and disorder in Hellenistic Greece (Polybius 36.17.5–9) might refer to the wealthier citizens and constitute a geographic and socially restricted phenomenon (Alcock, 1993: 25–26), in spite of the generalized formulation used by Polybius ("In our time

the whole of Greece has been subject...") (see also Paterson, this volume). Moreover reconstructions on the basis of ancient evidence offer a fragmentary picture, with a bias towards certain periods, such as the Classical, or certain cities and regions. But even when a broader picture is available, its interpretation is problematic, as it is often the product of lumping together information from different periods, geographical regions and kinds of sources to construct an overall single picture (see Parkin's critique [1992: 6] and this volume, on how average expectation of life is estimated on the basis of grave inscriptions).

Archaeological survey, with its broader geographical context and time-depth, gives a foundation to evaluate the scale of these demographic observations. It is sensitive to regional variability, it helps assess the relationship between town and country, and reveals patterns related to the behaviour of all social groups and not to selected data. Furthermore it can help evaluate the size and boundaries of our population sample and correct biasses inherent in the information of other sources. In this perspective, surveys have a lot in common with historical demographic work, putting together small regional pictures from which, through comparative work, broader regional and temporal pictures emerge. Yet the above idealized picture refers to the potential of regional surveys. In reality:

1. The credibility of the results has to be evaluated within each regional context on the basis of the problems and conditions posed by the specific survey area, the methodology followed and specific answers given to a series of questions related to the recovery, dating and interpretation of the data (see the papers in the first part of this volume).
2. Estimation errors caused by the non-contemporaneity of sites must be taken into account, and these are more difficult to evaluate. The general trends revealed in period by period sequences treat together information in periods of usually 200–300 years. By adding up information that might not be contemporaneous, this creates a spurious mean for the whole period that balances short term fluctuations and masks the dynamics within the period. Further, it creates a distorted picture, especially when the periods are large, and small, short-lived sites the prevalent habitation type (see Sbonias, this volume; Chapman, this volume and Wilkinson, this volume).

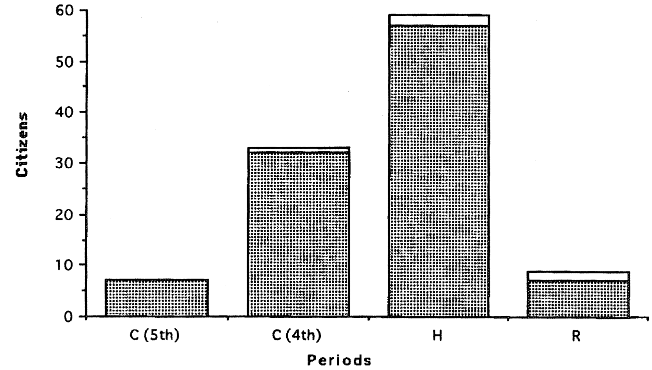


Figure 16.1. Citizens of the Deme Atene mentioned in epigraphic evidence from Athens (after Lohmann, 1993: 271, table 12).

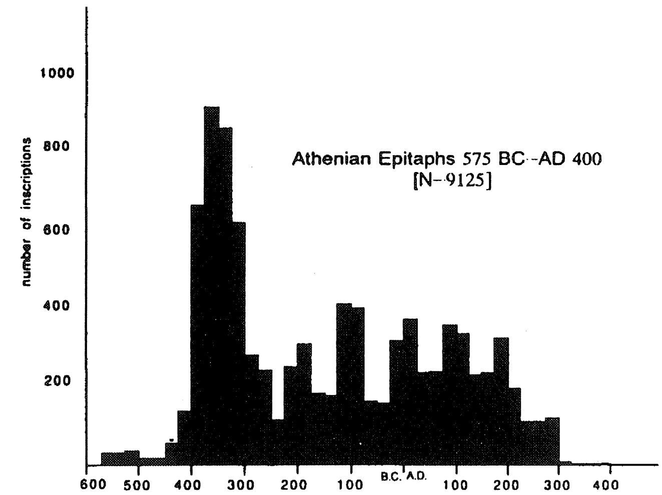


Figure 16.2. Athenian Epitaphs (575 BC – AD 400) (from Meyer, 1993: 100 fig. 1).

An example from Classical Attica

Classical Attica, a well documented area in the historical sources, with many of its cemeteries excavated and its territory well explored in an extensive way (Figure 16.4) and with a rich collection of inscriptions available (Figure 16.2) offers a good area to see how information from different sources complements each other. I present as an example how surveys help assess the graph in Figure 16.1, that presents the number of citizens of the Attic deme (parish/commune) Atene that are commemorated in private and state inscriptions found in the city and cemeteries of Athens (Lohmann, 1993: 271, table 12). Several biasses are inherent in these percentages, for example the under-representation of the country demes in the epigraphic material that comes exclusively from the city of Athens (Lohmann, 1993: 270–271 Table 12), or in respect of changes in the form of epitaph commemoration practices. Demotic (parish) names appear for the first time on stone grave-markers after 403/2 BC and numbers of epitaphs rise significantly in the first half of the 4th century BC (Figure 16.2), according to Meyer (1993) as a result of a new emphasis on the individual's assertion of citizenship. But apart from biasses epitaphs could reveal real trends too. The epitaphs that commemorate citizens from the Deme Atene were found in Athenian cemeteries, and thus show a percentage of the deme-population resident in Athens. Their numbers could therefore reflect a migratory trend growing from the end of the 4th century into the Hellenistic period (for the use of tombstones to testify

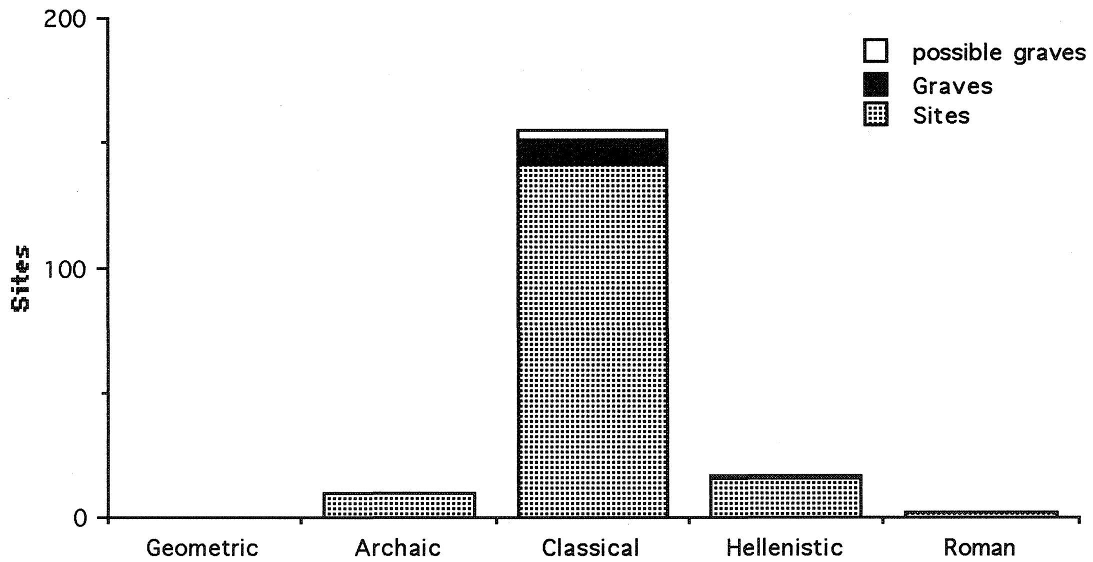


Figure 16.3. Sites found by the Atene Survey (after Lohman, 1993: tables 14–14).

migration from the countryside into Athens see Damsgaard-Madsen, 1988).

But it is difficult to distinguish biassed information from reality and evaluate the significance that this pattern, coming from the epigraphic evidence, could have for the size and florescence of the rural deme Atene, unless we put it in the broader picture gained from the survey of the deme itself (Figure 16.3; after Lohmann, 1993). So the absence of commemorated citizens in the epigraphic material of the 5th century (Figure 16.1), a period with a flourishing settlement pattern in the deme itself (Figure 16.3), could be linked primarily to the rare appearance of epitaphs in 5th century Attica (Figure 16.2), although in the case of the city documents this could reflect either the underrepresentation of the land demes in the epigraphic material, or, the fact that people were living predominantly on the land and not in the city. The settlement pattern of the 4th century is comparable to the frequency of the epigraphic evidence, reflecting the dense landscape of the rural deme. As these epitaphs of Atene citizens appear first in the last quarter of the 4th century (Lohmann, 1993: 271), a time when the overall number of Athenian epitaphs was declining (Figure 16.2; Meyer, 1993: 100 fig. 1), they could indeed reflect a migratory trend towards Athens, involving according to Lohmann approximately one fourth of the citizen-population (Lohmann, 1993: 279). On the other hand the large number of names mentioned in state documents and grave inscriptions of the 3rd to 1st century BC (Figure 16.1) as well as the wide spectrum of state offices, even of the highest grade, held by citizens of the Deme (Lohmann, 1993: 284), stands in contrast to the dramatic decline and depopulation of the rural landscape of the deme from the turn of the 3rd century BC and onwards (Figure 16.3). In this case the bulk of epigraphic evidence reflects total rural abandonment and migration

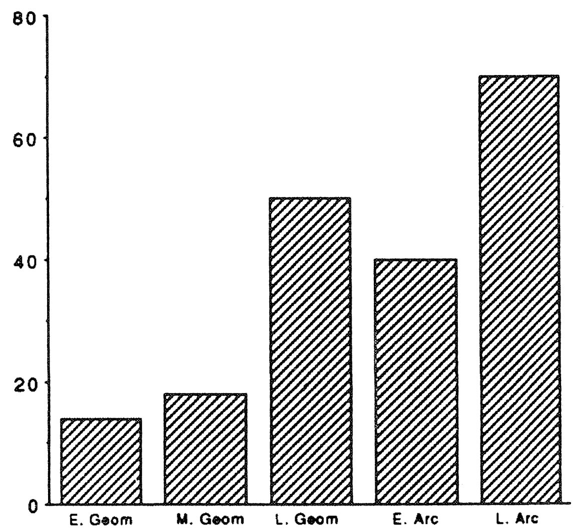


Figure 16.4. Known Attic Sites from the Geometric to Late Archaic Period (extensive work) (after Bintliff, 1997, b and Morris, 1987).

into Athens (reflected also in the abandonment of graves in the survey area, cf. Figure 16.3) within an overall picture of population decline of the city itself and increased nucleation.

Furthermore the survey results give an insight into the different rhythms of the development of the Attic landscape from the late Archaic to the Classical period. The low Archaic population reflects the non-deme status (unofficial parish) of the area in this period. As Lohmann remarks, Atene is a Classical and not a Kleisthenic deme (Lohmann, 1991: 241). The survey thus reflects regional variability, with marginal areas as Atene being colonized mainly in the Classical period (compare the pattern of

	Population from archaeological evidence				
Period/date	Hermion town	Halieis town	All survey area	All Southern Argolid[a]	Population from historical evidence
Archaic	2,110	1,220	5,880	6,760	
Cent. V	3,165	1,680	6,880	7,910	5,136–7,500[b] 2,000?[c]
Cent. IV	4,220	3,780	10,855	12,485	
Late cent. IV	4,220	2,100	9,175	10,550	8,000?[d]
MR			4,570	5,255	
LR			8,055	9,265	
1530 A.D.					3,868[e]
1700					2,101[f]
1848					7,954[g]
1896					12,549[g]
1961					11,255[h]

NOTE: *MR*, Middle Roman; *LR*, Late Roman.
[a] Estimated as 115% of survey area population.
[b] Hermion, 480/79 B.C. minima; citizens only. The two figures are calculated on the assumption that men aged 18–49 or, alternatively, 20–39 were sent to fight. See Table B.4.
[c] Tiryns, 480/79 B.C. minimum; citizens only.
[d] Based on the amount of grain received from Kyrene ca. 328 B.C.; citizens only. See Table B.5.
[e] Topping, personal communication. See Appendix B.1.3.6.
[f] From the Grimani census (Panayiotopoulos, 1985: 248 and table 26). See Table 1.2C.
[g] Khouliarakis, 1974. See Table 1.3A.
[h] National Statistical Service of Greece, 1962b. See Table 1.4A.

Table 16.1. Population in the Southern Argolid according to archaeological and historical evidence (from Jameson et. al, 1994: 562 Table B.6).

Figure 16.4). This counterbalances generalizing static pictures that emerge from treating the bouletic quota (parish councillor lists) as a reflection of the relative proportion of population in different parts of Attica in late Archaic Attica (Osborne, 1985: 43 and map 2).

Temporal sequences

Yet a differentiation must be made in the reliability of constructing temporal sequences on the basis of survey results. Table 16.1 from the Southern Argolid survey, that compares population estimates on the basis of survey results and historical documents (Jameson, Runnels and van Andel, 1994: 562–63, Table B.6 and B.7) helps illustrate the point. Surveys are theoretically capable of offering a complete sequence of population estimates from the beginning of the Bronze Age. As we go back in time, though, exact estimations are less accurate, as prehistoric data are more subject to problems of recovery, uncertainty on contemporaneity of sites etc. It is mainly for the Geometric and especially Archaic to Late Roman periods that the Argolid survey gives a reliable picture. This offers a more complete and detailed sequence in comparison to the information from the historical sources that focus on the 5th and late 4th century. Yet within such periods of high resolution in the documentary evidence, we have the possibility of going beyond the relative scale offered by surveys, to detect short term fluctuations due to migration, wars, epidemics, that don't have a wider impact and so cannot be detectable in the 'moyenne durée' of surveys (see for example in Figure 16.5 a picture of the short term fluctuations as reconstructed for 4th century Athens by Hansen, 1986). Furthermore on the basis of such estimations of well documented historical periods survey results can be reevaluated (see Bintliff, 1997, a, who compares survey figures with ancient historical figures for Boeotian population to assess the magnitude of missing survey sites).

The situation for later periods is questionnable. In the above example from the southern Argolid (Table 16.1) census figures are used exclusively to complement the survey picture for later periods. The archaeological contribution is limited and gives a general figure for the medieval period, as the successive occupation on the same sites masks the occupation in the last six-seven centuries (Jameson et al., 1994: 549–545 Table B.2, 554–555). This is not an exceptional picture, on the contrary survey results are often considered as an unreliable source for the medieval period, a result of the low visibility of sites and pottery of the period and inadequate knowledge of the local wares. Yet regional variability plays a role here, Greece for example being less subject to such low visibility than Italy (cf. Barker et al., 1986: 292, Barker, 1995: 48 and Ginatempo and Giorgi, this volume, on the sparse archaeological information on early medieval settlement in Italy). And although it is often argued that as we move towards recent periods detailed information from documentary sources leaves vague survey studies behind, survey studies refining their pottery typologies have the possibility to create credible comparable patterns.

The Boeotia survey gives a good example for the comparison of survey results (Figure 16.7) with the demographic development of Boeotia as seen in the work of Machiel Kiel on the Ottoman imperial archives (Figure 16.6; after Kiel, 1997 and this volume). The following are the main points of demographic development as revealed in the historical documentation (cf. Bintliff, 1995 for overview) (Figure 16.6):

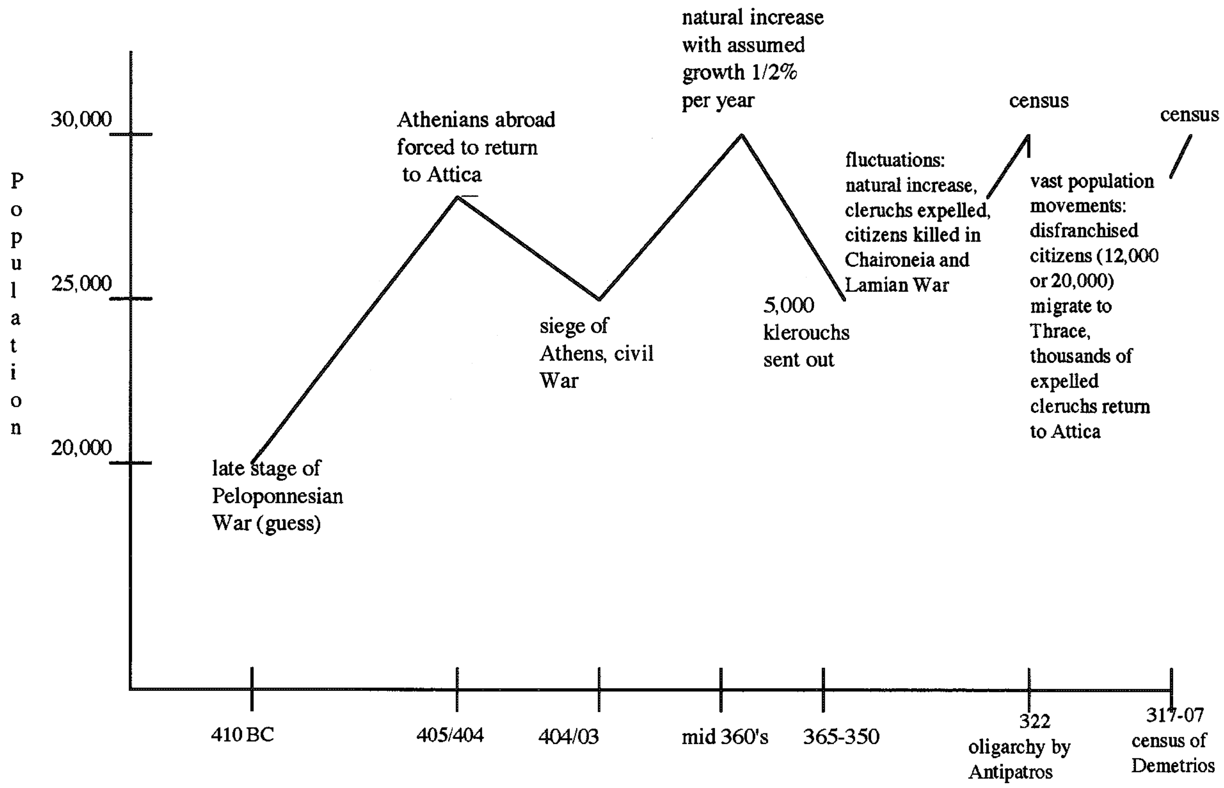


Figure 16.5. Estimation of the Athenian adult male citizen population living in Attica (after Hansen, 1986: 68–69).

1. a picture of massive depopulation in the late Frankish period, as a result of the mid-C14th Black death and increasing warfare between Franks, Byzantines and Ottomans (Bintliff, 1996).
2. large scale colonization of the Boeotian landscape by Arvanites – people of "Albanian" origin that migrated to Greece in the medieval period, retaining to a large extent their own regional identity till the presentday – in the late Frankish Period, just before the Ottoman occupation. The population record of the 1466 census reveals this colonization clearly, as according to Kiel 47% of the households in the Kaza (ottoman administrative district) of Thebes are Arvanitic (Kiel, 1997).
3. Steady population increase in the early Turkish period between 1466 and 1570.
4. Stagnation and decline in the late Turkish period (census 1642, 1688, 1800) with a revival in the Early Modern period (census 1879, 1896).

The survey results do reveal the general trends (Figure 16.7): a considerable population increase between the Frankish (LByz/F) and early Turkish Period (F-T), decline in the late Turkish (T), with a revival between the late Turkish and early modern period (T-Mod). Although in the graph the lack of differentiation between periods (F-T and T-Mod are hybrid phases) fails to show the exact subperiod in which the change took place (the early Turkish and early Modern), this might be possible through the further study of the domestic wares found by the survey. The exact magnitude of the population increase in the early Turkish period (the population quadruples within a century according to Kiel) is revealed less in the number of sites, that show a smoother effect, and more in the size of the villages that grow considerably (Figure 16.8). Furthermore the survey misses the very low population level of the late Frankish period, a short term decline that resulted in the massive colonization by the arvanitic immigrants. These sites that are the result of this colonization are definitely found by the survey, as they are associated with a new pottery style and mark the relocation of villages. Yet the survey results for the Late Frankish-Early Turkish Period (F-T) contain both the result of the arvanitic colonization, that almost doubled the population within a very short period around 1400 AD, and the considerable natural population increase within the Early Turkish period, and don't differentiate clearly between these two phenomena. In the Boeotia survey the constructive dialogue between survey and documentary evidence from the Ottoman Imperial archives studied by Machiel Kiel goes further in the attempt to develop methodologies for monitoring such problems. The exactly dated villages listed in the archives are linked with sites found by the survey and located in the landscape (160 villages have been located from the 200 villages listed; cf. Bintliff, 1995, and Bintliff and Kiel, forthcoming). Further through this link, that provides accurate dating for the sites, local ceramic sequences of the early medieval and high medieval pottery

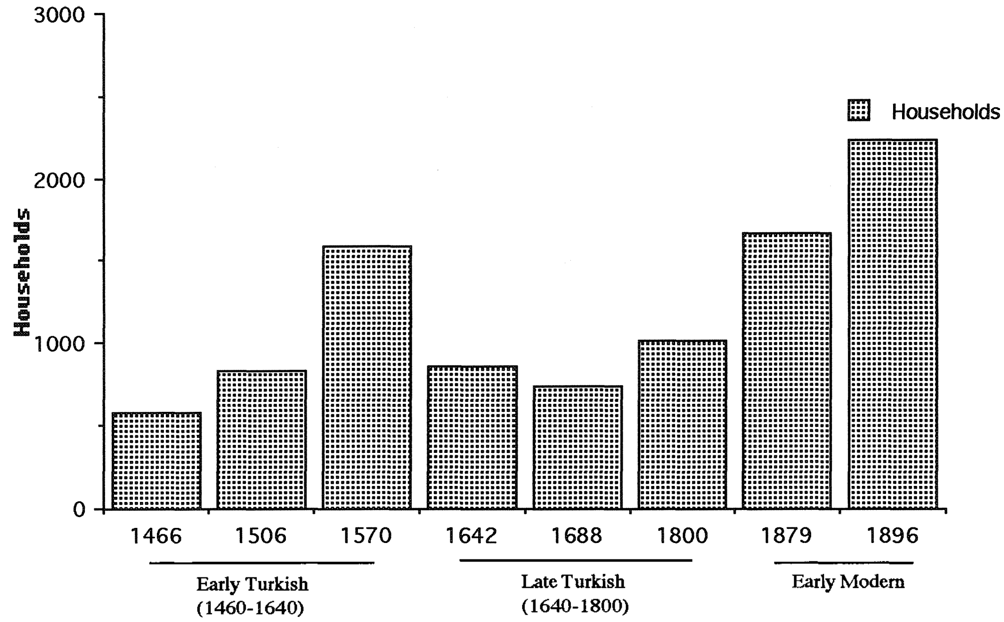
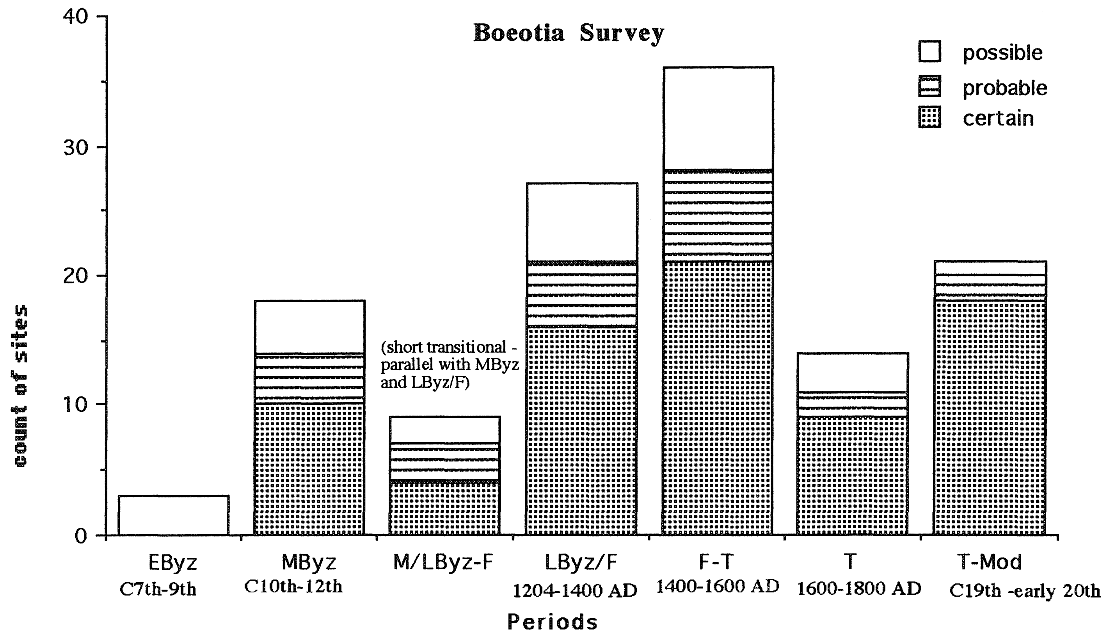


Figure 16.6. The demographic development of Medieval to Early Modern Boeotia as reflected in the number of households of 16 Boeotian villages (after Kiel, 1997 and this volume).



Early Byzantine (EByz), Middle Byzantine (MByz), Late Byzantine/Frankish (LByz/F),
Late Frankish-Early Turkish (F-T), Late Turkish (T), and Late Turkish-Early Modern Period (T-M)
after Bintliff 1991 (EByz, MByz), Bintliff and Snodgrass 1985 (T, T-Mod), and pers. comm. (F-T, T)

Figure 16.7. Settlement trends in Medieval to Early Modern Boeotia as reflected in the Boeotia survey.

are being reconstructed, that can improve the visibility of these periods in a fundamental way.

Historical data: from models to perceptions

Although some archaeologists would be satisfied with the middle to long term picture of relative population size that was sketched above, the great level of detail that ancient historians seek can be useful, if the sources are considered reliable. With surveys we lose the possibility of looking at the people themselves, what we see is how the adding up of the many individual histories that make up the population is reflected in the landscape. Historical sources can go beyond the spatial aspect of surveys and

give glimpses into the behaviour of specific people, showing how certain processes work and date these precisely (Alcock, 1993: 79). And although it is sometimes surveys that will give information on small-scale landholders, or the relationship between city and land, it is historical sources that will allow a look at individual experiences, permit an insight into certain events of political history, and enable observations on the economic and social structure of the population (see discussion on the ratio of citizens – non citizens in the Argolid survey in Jameson, Runnels and van Andel, 1994: 563ff, and the prosopographic study of the citizens of the Deme Atene in Lohmann, 1993: 271ff).

Furthermore, survey spatial evidence confines itself to the perception of population inhabiting an area. There are other notions of population based on political and social criteria that crosscut the spatial habitational perception of population on which surveys are based. These references to populations defined politically and legally, and not geographically, don't always correlate with figures estimated by intensive surveys. For instance in the above example of the Deme Atene the territorial aspect of the deme is without doubt right, as the discovery of the ancient border inscriptions shows, defining exactly the borders and size of the deme. But at the same time there is the concept of the deme as the whole of its citizens, which includes a growing percentage of citizens resident in Athens from the 4th century onwards (Lohmann, 1993: 269). Hansen notes that in the case of Athenian citizens, the ratio of citizens living in Attica to the total number of citizens, including citizens in foreign armies, Athenian metics in other cities, or Athenian klerouchs, was 4:5, in some periods even 3:4 (Hansen, 1986: 8). Such distinctions are important, as demographic determinants have a different significance for the two concepts of population. So according to Hansen the citizen population in Classical Athens was growing as a result of natural increase, block grants of citizenship in the C5th and citizenship of the emigrants retained in their city of origin, whilst the number of citizens living in Attica in the 4th century might have been stationary or declining due to emigration or the reduced effect of fertility in counterbalancing mortality, as only children from both citizen parents were recognised as citizens (Hansen, 1986: 8–9). Surveys therefore help us get a glimpse of the natural, geographically defined, demographic entity, counterbalancing uncertainties in the ancient sources as to whom the numbers mentioned refer to. On the other hand historical sources help us understand ancient concepts of population and gain an insight into the demographic behaviour of socially defined groups. More often though this information refers to the middle and upper classes, as it is these that are mainly documented in the sources (Hopkins, 1983; cf. though Sallares, 1991: 118 on the demographic behaviour of slaves). The same is true for certain cemetery studies, that are often dismissed as biassed towards certain classes, age groups etc. As far as can be defined what such cemetery samples represent, cemetery analysis could give information on the demographic characteristics of specific population groups (cf. Étienne and Fabre, 1970; Masset, this volume).

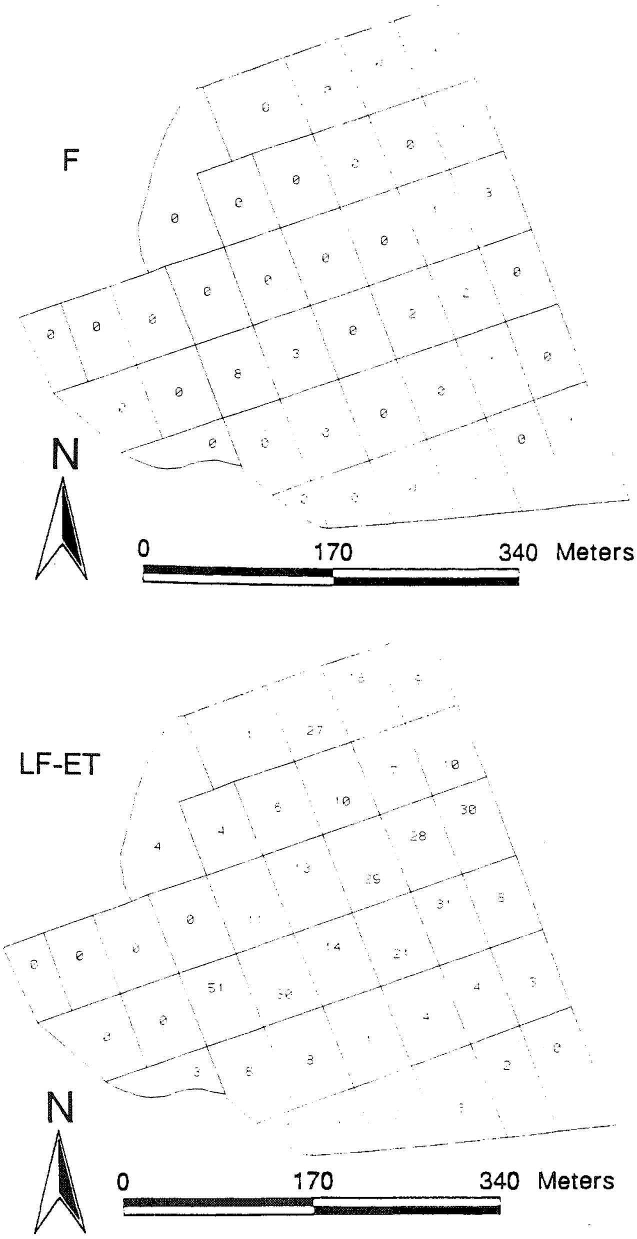


Figure 16.8. Comparison of the Frankish (F) and Late Frankish-Early Turkish surface ceramic distribution on the site VM 4 (from Gillings and Sbonias, in press).

Estimating growth rates

Till now we have argued that surveys can offer a period by period sequence of settlement density and show cycles of decline and growth in the settlement pattern. But as surveys primarily record patterns of artifactual distribution, related not only to fluctuations in population levels but also reflecting changes in the settlement system, land use and

Century	Population estimate
VII	2800
VI	10667.5
V	12840
IV	12015
III	2917.5
II	12455

Century	Population growth rate per annum
VII–VI	2.81%
VI–V	0.2%
V–IV	-0.07%
IV–III	-0.76%

Table 16.2. Summary of estimated population history (after Perkins, in press, fig. 7 and tables 2–7) and estimated population growth (after Perkins, in press table 8) of the Albegna valley and Ager Cosanus (C7th–2nd BC).

Period	Date	Duration	Population
Archaic	700 BC–480 BC	220 years	5,880
Classical	480 BC–350 BC	130 years	6,880
late C–early Hellenistic	350 BC–250 BC	100 years	10,855
late H–middle Roman	250 BC–AD400	650 years	4,570
late Roman	C5th–C6th	250 years	8,055

Table 16.3. Estimated population history of the Argolid survey (after Jameson et al. 1994, 562–63 Table B.7).

land holdings, it is important to keep in mind that site numbers and their rate of growth are not correlated in a straightforward way with population growth rates. A picture of a dense settlement pattern overestimates growth rates, as the large number of small sites is disproportionate to the population size associated with them (in the Southern Argolid small Classical farmsteads found by the survey could represent 5% of the total population estimated, rising to 16% if four times as many sites remained to be found [Jameson et al., 1994: 55]; in Boeotia the figure is 20%, Bintliff, 1997, a). Although we must understand the relationship between rates of settlement growth and population growth, I don't think that a general model of this relationship can be used to assess population growth rates from settlement growth rates, as size of sites, or density of habitation, might be temporally and geographically variable. Whenever possible, attempts to reconstruct absolute population numbers, taking into account the size of individual sites as well as other factors causing distortion, could produce a more reliable picture for the general scale of growth rates, and not of course exact figures. Table 16. 2 (after Perkins, in press) presents an attempt to estimate annual population growth rates on the basis of absolute population numbers for hundred year periods, as estimated on the basis of survey results. Here problems of contemporaneity of sites might affect less the reliability of the results. Table 16.3 from the Argolid survey in contrast, using periods of several hundred years , although it gives an impressionistic picture of the population growth with a population doubling between Archaic and early Hellenistic, makes it difficult to estimate exact growth rates. Are these figures a peak reached at the end of each period? Usually an annual rate of increase estimated on the basis of surveys is assumed to be evenly distributed within the middle-term periodisation of surveys, ignoring therefore the exact dating of population peaks and thus the form of the growth curve, that could vary according to whether it is fitted into shorter or longer periods (see Sallares, 1991: 63). Refinement of our chronologies is essential in order to follow development within such long periods.

In assessing the results of such exercises for the evaluation of growth rates, we shouldn't forget that the population size we observe in the settlement pattern doesn't constitute an exact reflection of the original demographic condition. Population size as seen in the settlement pattern is a synthetic measure. It includes the result of the demographic condition (natural births and deaths), plus the effect of political events such as wars and population movements, plus the reaction of the population in terms of internal and external migrations in order to maintain the balance. Although internal migration within the region as a whole is detectable through town and country survey and survey coverage of different sectors of a region, external migrations (as are not infrequently recorded from our sources for the Greek and Roman world) must be evaluated for their possible contribution to regional survey statistics. Archaeological surveys in regions where for example Greek or Roman long-distance colonisation changed the local demographic landscape, show that the long-term impact of the colonisation, spreading over centuries, definitely shows up on the landscape (see for example Wightman, 1981: 281–282 for the Liri Valley; Carter, 1990 for Metapontum; Keay, 1992: 303–309 for Spanish Turdetania). However in contrast, such historic phenomena often fail to match up with survey results in the short term, a failure that may be connected to methodological problems in the recovery of sites and our lack of knowledge of fine chronological distinctions in the ceramic finds for certain periods (see discussion for the Ager Cosanus in Dyson, 1978: 258–273 and Attolini et al., 1991: 144). Minor population movements, or other incidents of political history that cause short-term demographic fluctuations, are not easily reflected in the recovered settlement pattern, and it is mainly through historical sources that their magnitude can be assessed (in Figure 16.5 a series of such short term fluctuations for 4th century BC Athens can be seen, as reconstructed by Hansen [1986] on the basis of ancient sources).

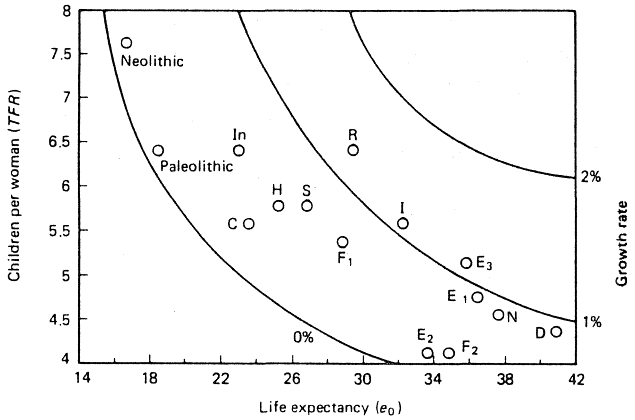
VITAL EVENTS

In the first section we discussed two steps in the demographic study of past populations: i) population size and fluctuations as seen through a constructive dialogue between survey results and historical sources, ii) estimation of growth rates on the basis of absolute population figures

mainly offered by surveys for ancient periods, and more accurately complemented by census data for later historic periods. But measuring growth and decline or observing the static size of a population is not adequate. As size and growth are synthetic measures, we must move a further step and try to study the demographic factors that regulate changes. Being able to study the formation of these aggregate data by the vital events of mortality and fertility, is important for the understanding of the mechanisms that create these figures; how biological, social and cultural factors determine the level of these variables.

The complex relationship between demographic functions and population can be seen in Figure 16.9 (Livi-Bacci, 1992: 21–22 fig. 1.8a and 8b), where the demographic situation is expressed not merely in terms of growth but also in terms of the strategic space the populations occupy in respect to fertility and life expectancy. Several bands of growth rates ("isogrowth" curves) can be seen, with populations placed in the space of growth according to the function of life expectancy at birth and number of children per woman. The evaluation of the position of a population in this space of growth is important for understanding the population under study, as a variety of vital events can have as a result a similar growth rate (see also Bagnall and Frier, 1994: 36, fig. 2.2). A small growth rate obtained through low mortality and fertility, indicates different things in comparison to a society where the same growth rate is achieved by high mortality and fertility. The difference in the strategic space of the Paleolithic and Neolithic populations, for example (Figure 16.9) which are assumed to have had similar growth rates, reflects two different systems: a hunting and gathering population characterised by moderate fertility and lower mortality on the one hand and a sedentary population characterised by both higher mortality and fertility on the other hand (Livi-Bacci, 1992: 22–23 fig. 1.8b).

Surveys totally ignore this dynamic interplay of basic demographic functions. It is characteristic for example how the rural population is estimated. For example in Classical Greece a standard figure of 5 persons is allowed per nuclear family inhabiting a farmstead, and a population figure is computed by multiplying with the number of farms or number of houses per site. But such a method using a static figure ignores regional and temporal variations in household size and fluctuations in the demographic functions that bring change. It is mainly the actual growth or decline in the number of sites that on another level reflects the dynamic process of demographic forces and controls the credibility of the estimated overall population size. But this dynamic process is reconstructed from small static pictures that put together show the change, but fail to explain the mechanisms and show the dynamics behind it.



C = Rural China, 1930	E_1 = England, 1550-1600	F_1 = France, 1750-9
D = Denmark	E_2 = England, 1650-1700	F_2 = France, 1800-9
I = Italy, 1862-7	E_3 = England, 1750-1800	N = Norway, 1780
S = Spain, 1797	H = Hungary, 1830	R = Russia, 1897
In = India, 1900		

Figure 16.9. Relation between fertility (the average number of children per woman) and life expectancy in prehistoric and historic populations (from Livi-Bacci, 1992: 21–22 figure 1.8b).

Cemetery data

Here, in this attempt to evaluate the actual vital events, is where information from cemetery studies comes to the fore. I will not consider attempts to compute life tables on the basis of ancient information such as tomb inscriptions, or census data, as there is a considerable critique of their reliability (Claus, 1973; Hopkins, 1987; Parkin, 1992: 4–17). Cemetery data too have to face a considerable critique. Questions of reliability must be taken into account, for example the reliability of the age and sex definition of the skeletons, the degree that a specific cemetery is representative of larger populations, and within the cemetery the representativeness of the population in terms of age, sex, social class (cf. Acsádi and Nemeskéri, 1970; Weiss, 1976; Schacht, 1981: 121–122; Boquet-Appel and Masset, 1982; Buikstra and Konigsberg, 1985; Ammerman, 1989; Parkin, 1992). Problematic is also the fact that often data from several cemeteries and geographical regions extending over a long period are used to compute life tables aiming at an overall picture of mortality and fertility as a whole (cf. Weiss, 1973 for example). A general picture emerges ignoring the regional and temporal variability. Yet as these problems are recognised, more sophisticated cemetery excavations are planned, to provide reliable samples and allow detailed analysis at shorter intervals.

The excavation of the Pantanello Necropolis in the territory of ancient Metaponto in southern Italy is such an example of a large burial ground related probably to the local rural population of the chora of Metaponto (Carter, 1990). Its careful total excavation and dating allowed its excavators to break down the burials in half century intervals between 600 and 250 BC (Figure 16.11). Further, Pantanello Necropolis is one of the few examples where the large sample of 320 burials can be compared with the results of the intensive survey of the chora of Metaponto (Figure 16.11). It is encouraging for the comparative study of these data that the trends revealed by the two different

kind of sources run, with some variation, in parallel (Carter, 1990: 19–23). Trends in burials in the period 600 to 350 BC generally reflect population trends in the settlement pattern of the territory in the previous 50 years (Figure 16.10). In the period 400–350 BC an equilibrium between a low number of sites and burials has been formed, a result of the stable low number of sites in the previous hundred years. In the last two fifty-year intervals no time lag can be observed between population trends reflected in the burials and in the territory, on the contrary the number of burials reflects rural site density in a direct way.

On the basis of the organisation of the Necropolis in clusters, orientation and close proximity of graves, and evidence from the analysis of the skeletons on age, sex, blood types and genetically determined characteristics of the deceased, the excavators tried further to identify family groups buried in the cemetery, and, when possible, reconstruct hypothetical family trees for individuals buried in the same cluster (Carter, 1990: 30–42). A total of 64 family groups were defined for the three centuries in use, an average of 20 to 21 families burying there in any period between 500 and 300 BC (Carter, 1990: 39). Using figures on life-expectancy rates from life-tables derived from the cemetery data, they estimate the theoretical number of burials that a population of 20 families (5 members per family) would have made in the period of 200 years. Comparing this hypothetical figure (800–940 persons) with the number of burials found in the cemetery (273) a considerable discrepancy becomes evident, suggesting that in spite of the complete recovery of the burials only one third of the burials of the original population might have been discovered (Carter, 1990: 40). The excavators notice that even allowing for underrepresented infants, unrecorded child burials (ratio of children to adults 1:4) and underrepresented males that were possibly buried elsewhere (ratio of men to women 1:2) about 300 burials are still missing. In their opinion this discrepancy must be attributed to the assumption of stationarity on the basis of which the life tables were

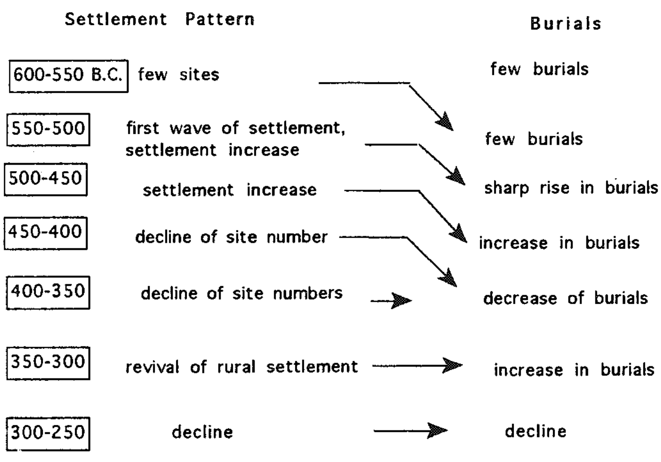


Figure 16.10. Cemetery and survey data from the Pantanello Necropolis and the Metaponto survey (figures from Carter, 1990: 21–22).

computed, as well as to the use of an ideal family number of 5 people to estimate the population. The independent survey data instead show the correct measure, pointing to a population that was not stationary but was declining in the second half of the 5th century (Figure 16.11).

The above example from Metaponto, apart from the usefulness of cemetery analysis, illustrates two main problems with cemetery data. First of all the assumption of stationarity on which the interpretations of skeletal data are based. As Willigan and Lynch (1982: 45) notice, there are two sources of deviations from stationary models: i) the short term crises, ii) the existence of population growth itself. A high error of estimation might especially result when a population is growing, as depending on the growth or decline of the population, mortality rates can be overestimated or underestimated (Ammerman, 1989: 73–74). In this perspective information from surveys on total population size and changes over time are crucial for a successful examination of a population's vital rates.

Secondly there is the question of whether we could use demographic information derived from cemetery data as representative of the demographic condition of the population. In the above example from Metaponto for instance, in spite of biasses in the cemetery data, such as the underrepresentation of children, underrepresentation and possibly partial exclusion of males or in some cases segregation of children and women, the life table computed, although biassed below age 15, is thought to be reliable, as "from age 15 upward (it) gives information about adult mortality that practically repeats findings for separate sexes" (Henneberg and Henneberg, 1990: 78). Furthermore it could offer some evidence of the structure of the nuclear family, consisting according to M. and R. Henneberg (1990: 80) of 4–6 members. Yet a definite answer to this question, that has to take into account a series of critiques on the weaknesses of skeletal ageing methodology has to be left to the paleodemographers themselves (see Bocquet-Appel and Masset, 1982 for critiques and Buikstra and Konisberg, 1985 for an answer; also Masset, this volume and Francovich and Gruspier, this volume).

It is also remarkable that in the above example, in spite of the exact dating of the graves for the computation of the life table, all the cemetery data were treated as a single sample, due to the fragmentary state of the skeletal remains. The dynamic aspect within these data is ignored. In the end it is the archaeological data, dating of the graves and sites, that offer a more precise picture of the period by period fluctuations (Figure 16.11).

Model life tables

As a result of uncertainties in life tables describing the demographic experience of past populations as observed in cemetery data, many ancient historians and paleodemographers rely on computerised models of all possible populations for different mortality levels and various growth rates, in order to gain a hypothetical pattern of vital

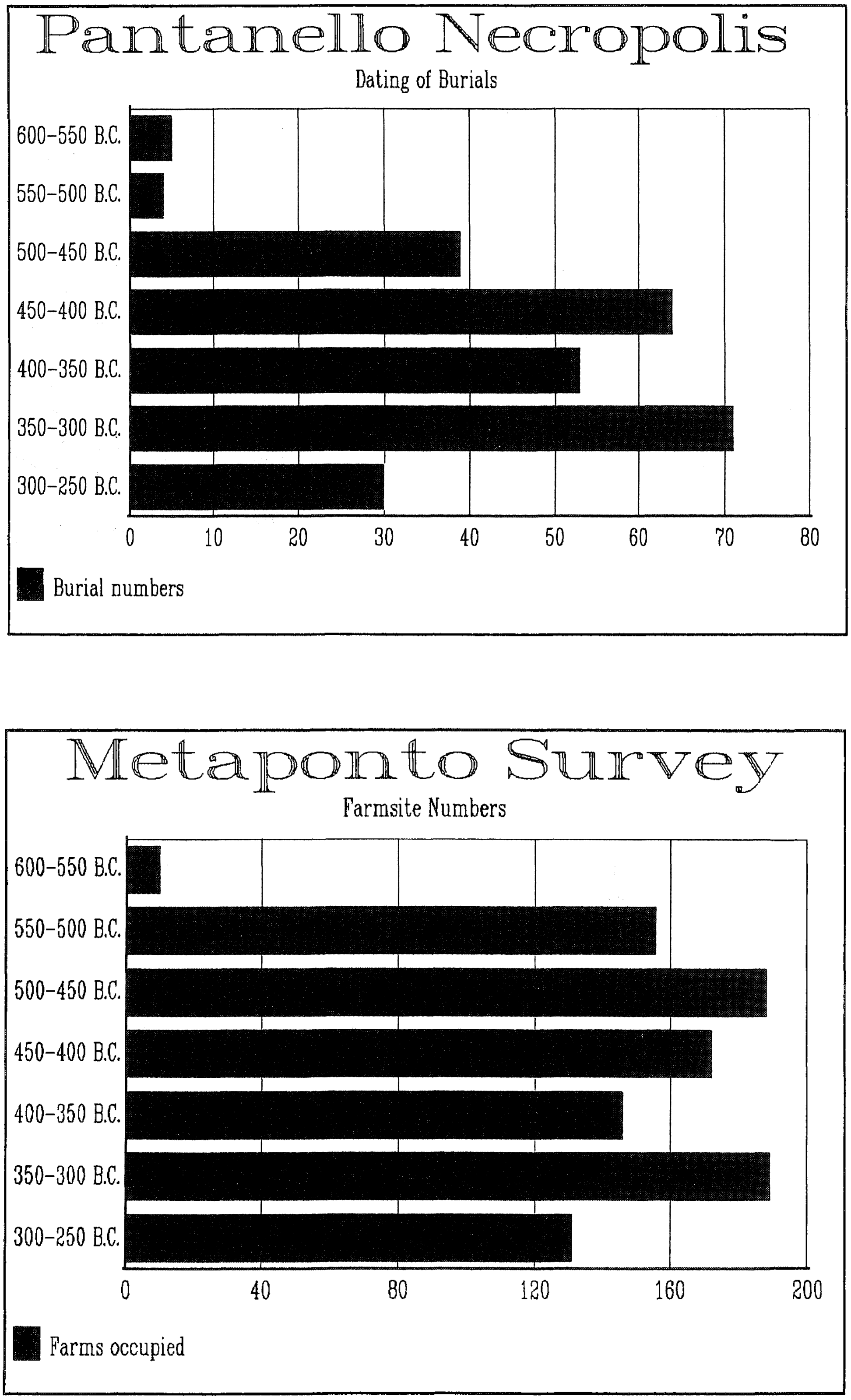


Figure 16.11. Comparison of the settlement and cemetery pattern of the Metaponto survey and the Pantanello Necropolis (from Carter, 1990: 19–24).

events. The use of uniformitarian assumptions allows the deployment of concepts developed in formal and historical demography to assist in the description of patterns in the past (Howell, 1976: 34). An example of how model life tables are used by ancient historians is given by the calculation of the size of citizen population on the basis of army figures. Models are used to gain an awareness of the probable age structure of the ancient population, so that from a cited figure of an age class, for example men of certain age called into the army, the number of 19 year old men etc., the size of the whole population can be estimated. Table 16.4, from Hansen, 1986: 9–13, shows the distribution of adult males for Model West, mortality level 4 (expectancy of life at birth 25.26 years) and growth rate 5.00 (annual increase 0.5%). In Table 16.5 Jameson *et al.* (Jameson *et al.*, 1994: 557, Table B.4) following this model of age structure try to estimate, on the basis of which age groups may have been mobilized for service in the Persian Wars, the total population of the cities of the Argolid.

Age	% of all time	% of all males 18–80+
18–19	3.85	6.7
18–59	52.47	91.3
18–80+	57.47	100.0
19	1.92	3.3
20–39	31.44	54.7
20–44	37.05	64.5
20–49	41.77	72.7
20–59	48.62	84.6
30	1.57	2.7
40	1.21	2.1
40–49	10.33	18.0
50	0.86	1.5
50–59	6.85	11.9
59	0.51	0.9
60–80+	5.00	8.7

Table 16.4. Distribution of adult males for Model West, mortality level 4 (life expectancy at birth 25.26 years) and growth rates 5.00 (annual increase 0.5%) (from Hansen 1986, 9–13).

But there are two things we have to consider when we relate such models to past patterns. First of all an assumption of the right scale of mortality levels and growth rates has to be made in order to choose the right model life table for our population. Are generalised pictures we have for pre-industrial societies adequate for choosing the right models? Furthermore we have to question the validity of a single demographic model over a wide geographical and temporal area (Sallares, 1991: 43). In the above example from Classical Attica, Hansen chooses his life table on the assumption of a growth rate of 0.5%, derived from paleodemographic data for Roman population. Surveys, as we have argued, can give guidance concerning the scale of the natural increase. Clearly more regional paleodemographic studies are needed. Within an interdisciplinary framework the discussions of ancient historians, archaeologists and paleodemographers on the one hand could be used as indicators of the general demographic conditions of past populations, on the other hand model life tables once chosen could provide exact information on the mortality levels according to sex and age structure.

A second factor that we should consider is the reference of model life tables to stable populations, i.e. the assumption of stable mortality and fertility profiles and of an unchanging shape of the age distribution across time (Weiss, 1976: 355–356). But here, firstly, short-term fluctuations are smoothed, such as famine, epidemics, which have though no severe consequencies for demographic structure (cf. Ward and Weiss, 1976: 6). Secondly, reliability problems are caused when dynamic changes in demographic structure take place. Such changes are detected very well in survey results in terms of changing population levels. In certain periods the change in the population level is so radical that it can't be attributed to a constant, cumulative rate. In the case of Greece the late Geometric might be such a period. On the other hand the population growth from the late Archaic to early Hellenistic period can be attributed indeed to a natural increase under stable conditions, as the approximate doubling of the population

Category	Akte	Epidauros	Troizen	Hermion
Troops mobilized[a]	5,700	2,800	2,000	900
Total men of military age[b]	7,125	3,500	2,500	1,125
Total citizen population of military age				
20–39[c]				
(ca. 15%)	47,500	23,333	16,667	7,500
20–49				
(ca. 20%)	35,625	17,500	12,500	5,625
18–39				
(ca. 17%)	41,912	20,588	14,706	6,618
18–49				
(ca. 22%)	32,386	15,909	11,364	5,136

NOTE: Cf. Beloch (1886: 123): 30,000 for the whole Akte, largely on the basis of the land areas of the city-states. Cf. also Faraklas (1973b), using Herodotus: 10,000–14,000 each for the Epidauria and Troizenia.
[a]Herodotus 8.43, 9.28.4.
[b] = 125% of previous figure. For troops mobilized as 80% of the relevant age groups, see Hansen (1985: 19).
[c]See text.

Table 16.5. Citizen Population of the Akte in 480/79 BC as estimated on the basis of the above model life table (from Jameson et. al. 1994: 557 Table B.4).

between Archaic and early Hellenistic times observed in many regional surveys is consistent with an annual growth rate of around 0.4%. The dramatic decline in the late Hellenistic era on the contrary is a dynamic change. Model life tables fail to take into account these dynamic conditions that are very well detected in survey results.

Survey trends and vital events

In the above discussion we already demonstrated that survey data can offer valuable background information to overcome existing biasses in the study of vital events, and evaluate discrepancies caused by common assumptions (i.e. stable and stationary populations).

A problem with surveys though is the degree of direct relationship between settlement pattern and demographic events. Generally, in the middle to long term, there seems to exist a quite straightforward relationship between a population growing and declining and the number and size of sites observed in the landscape. In the case of Pantanello Necropolis in the territory of Metapontum (Carter, 1990) we observed a parallel development between trends revealed in the burial data and trends reflected in the landscape, though often with a time-lag of half a century. A less straightforward relationship must exist between population size as reflected in the settlement density and the vital events that have altered to produce this population size. This has to do with the way that settlement patterns are formed. What we observe in survey data are dramatic contrasts between periods as a whole, which will not correspond in a proportionate way to the timescale of shifts in vital events. For example, a major increase in fertility rates could occur at an early phase of a cycle, which as a whole achieves a settlement system corresponding to a high settlement density. Sallares (1991: 62, 90–94, 101–102, 116) argues for the existence of a rapid period of growth in Greece in the late Geometric period, though the settlement pattern of this phase cannot be compared to the high level of site numbers achieved by the succeeding later Archaic and Classical periods. Yet it can be suggested that the later dense population was a product of this earlier process, indeed by Classical times Sallares assumes decreasing growth and fertility of population. Whilst the above example is far from clear (see Morris [1987] for another interpretation of the supposed population increase), we could suggest that a time lag might normally exist between vital events and the appearance of the effects of a certain demographic behaviour on the landscape. Settlement density is cumulative and can often be the long-term result of a past demographic behaviour. On the other hand a major modification of vital rates can be a good reflection of the overall demographic condition in a region and is important in its own right. For a glimpse into demographic events that are reflected in a direct way in the settlement pattern, we should look closely at those periods where population levels appear to change with some sharpness and new demographic cycles commence. (In the case of Greek developments, for example, attention should focus on the the final stage of late Geometric, the short-lived late Hellenistic, and the inception of the Late Roman, phases.)

CONCLUSION

The above discussion has shown that a fruitful dialogue between the different disciplines can provide complementary information at different levels. The contribution of regional survey is particularly remarkable in giving background information to a series of issues related to the first two levels of demographic analysis, the study of aggregate populations and the analysis of vital events. The third level of demographic analysis, that of biological and cultural mechanisms (for example age at marriage, birth intervals) is beyond the reach of archaeological survey information. Our knowledge of these aspects must derive from whatever can be achieved for a region using historical studies of well documented periods, or through the use of appropriate demographic models (see for example Hopkins, 1965, 1965–66; Eyben, 1980/81; Harris, 1982; Russell, 1985; Shaw, 1987; Sallares, 1991: 129–160; Parkin, 1992: 111–133), as well as through modern palaeopathological investigations of regional cemetery populations (Henneberg, 1976; Weiss, 1976: 358–360). Although surveys won't give information at this level of the demographic mechanisms, they prove valuable at the final level of analysis, that of the overall forces. At this macroscopic level together with historical analysis they help our comprehension of the environmental, social, political and economic conditions and constraints that cause the observed demographic cycles and give the possibility for explanatory models to be formulated (see chapters in the first part of the volume).

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17. The Contribution of Palaeoanthropology to Regional Demographic History

C. A. Marlow

INTRODUCTION

Humans leave no more immediate evidence of themselves in the archaeological record than their own biological remains. The anthropological analysis of human material, usually skeletal, provides individual estimates of sex and age at death. These data are then used to derive measures of community mortality in terms of the social unit which usually bonds the dead, the cemetery. It would seem an easy step to attempt demographic inferences from this apparently direct source, but this route is beset with problems both evidential and methodological. This paper examines the contribution of demographic data collected from cemetery groups to the wider study of past populations. The best use of this anthropological evidence is in combination with other sources, such as historical accounts, regional surveys and settlement excavation – an integrated approach. Two examples of the potential of an integrated analysis of demographic evidence are given. First an assessment of population affinities at the Anglo-Saxon site of Norton in northeast England, and second, an examination of the status of children from Roman-period Kellis in western Egypt.

THE PROBLEMS OF BURIAL ANALYSIS

Through the analysis of human remains, palaeoanthropologists attempt to understand the factors controlling past populations, and to explain temporal and geographical patterns and changes. At the primary level they are examining an individual burial group and assessing chronological mortality trends within it. The use of appropriate inter-cemetery comparisons can extend the population study to a regional perspective.

The most fundamental issue is to understand the nature of the populations which the anthropological data represent. How does demographic evidence derived from a dead, cemetery population mirror the living progenitor? How can information from individual cemeteries be combined to reflect regional demography? Problems are inherent to all stages of information transfer from the living population, via the dead, buried and excavated populations, to the analysed population. Account must be taken of evidential biases, such as variations in cemetery utilization and archaeological preservation, as well as methodological limitations. Some of the major causes of data transformation and loss are briefly addressed below.

Evidential limitations

a) Death
A dead population has a different demographic profile to the living population from which it has been derived. Death transforms the living, and only in catastrophic circumstances, where a whole community dies together, are the dead and living populations equivalent.

b) Differential disposal
To be able to relate a cemetery group to a living population, it is necessary to be able to define which particular community, or section of a community, used that cemetery. Differential ritual may exclude some individuals from a communal burial place. An under-representation of child and infant bodies is often attributable to alternative disposal practises (Steel, 1995 and Watts, 1989). For small communities, perhaps using only one burial ground, demographic biases may be readily identified. In larger population units, such as towns, several cemeteries may have been utilized, with access depending on a more complex range of social, economic or religious factors. How reliably can we determine who used which cemetery? Excavation and analysis of a sub-set of the whole will produce a biased sample which does not represent a 'real' population.

c) Temporal problems
To make full use of demographic data it is important to be able to achieve a reliable assessment of the time span of a cemetery. Many burial grounds have long periods of use

and this can pose problems. Early burials may be disturbed and damaged by later ones. To enable chronological comparisons within and between cemeteries, accurate seriation of burials is necessary, but it is often difficult to date graves or to produce reliable phasing. Valid demographic analysis requires a stable population, and so, to avoid problems of seriation, cemeteries utilized for a short period are most valuable. Unfortunately such burial grounds are unusual, because disposal of the dead is often linked to a continuing tradition of group identity and belonging.

d) Preservation biases

It goes without saying that any archaeological evidence is subject to preservational biases which limit the remains available for excavation and analysis. The more fragile remains of young and elderly individuals are least likely to survive intact, so imposing obvious demographic distortion (Guy *et al*, 1997; Paine and Harpending, 1998).

e) Regional relationships

To move from small-scale demographic analysis to the regional level, it is necessary to compare data from a number of cemeteries. All too often these comparisons are based on very few groups, whose temporal and social relationships are poorly understood. As a result, any interpretations are of dubious value. To establish more regional patterns, the anthropological evidence needs to be integrated with the broader archaeological and historical record of population mobility, socio-economic change and so on.

Methodological limitations

The problems inherent to the demographic data derived from human remains and the subsequent statistical analysis are well-known (Parkin, 1992), they are also reviewed by Sbonias, Gruspier and Masset in this volume.

a) Ageing techniques

There has been intense criticism of the many techniques used to establish the age at death of human remains. This has addressed problems including the tendency to underage old individuals, and for mortality curves to reflect reference populations (Bocquet-Appel and Masset, 1982, 1996; Molleson and Cox, 1993; Paine and Harpending, 1998). Recent research on documented populations, such as Spitalfields , has provided the opportunity to test ageing techniques on skeletal specimens of known age at death (Black and Scheuer, 1996; Molleson and Cox, 1993). Advances in methodology are continuing to be achieved (Jackes, 1992).

b) Sexing techniques

Methods used to sex skeletons are difficult to apply to immature remains. Remedies to this problem may be provided by the use of DNA analysis (Götherström *et al*, 1997; Palmirotta *et al*, 1997; Stone *et al.*, 1996) and of reference populations such as Spitalfields (Molleson and Cox, 1993).

c) Statistical techniques

The statistics used to analyse demographic data derived from skeletal and dental data have been soundly criticised (Bocquet-Appel and Masset, 1982, 1996). Life tables, for example, assume an absolute age at death (Boddington, 1987) which cannot be obtained from anthropological estimates. However, new and improved palaeodemographic indicators are being derived (Bocquet-Appel and Masset, 1996), and as long as the restrictions of this analysis are appreciated 'they can help us to gain a greater understanding of the population' (Parkin, 1992: 90).

The limitations of demographic analysis based on human remains are well appreciated by anthropologists. Methodological problems can be overcome by the ongoing search for new techniques for ageing and sexing, (Stone *et al.*, 1996) for example, and results can be assessed against appropriate ethnographic models (Buikstra and Konigsberg, 1985).

It is important not to deprecate anthropological methods of analysis too much, as this can lead to the marginalization of an important source of evidence. Skeletal analysis is often relegated to the microfiche of cemetery reports, and excavators frequently rely on grave finds rather than biological data to sex individuals (Henderson, 1989). This disregards problems with associated goods, illustrated by modern examples of placing female jewellery with dead males.

Ian Morris (1992) sees the limitations of burial evidence as no more problematic than those of other sources, 'every kind of evidence has it's own problems and gaps' and he asserts that 'the potential of burial evidence increases in direct proportion to the amount of other types of sources we have'. Many of the evidential limitations given above (differential disposal, regional restrictions) can be counteracted to some degree by adopting an integrated approach with a broader spectrum of archaeological and historical sources (Paine and Harpending, 1998). Rather than reducing the significance of anthropological data from burial sites, it should be synthesized with the results of settlement excavation, surveys and historical research, so enhancing the value of the evidence overall.

THE INTEGRATED APPROACH

Different sources of evidence complement each other. The multivariate study of past populations is not a new idea, and much integrated work is being and has been carried out. Cemeteries are excavated with associated settlements and conventional palaeodemographic data are allied with more general archaeological survey evidence. Success depends on good communication between researchers, and this colloquium provides an excellent opportunity for such exchange.

Unfortunately comparative studies are often viewed as trying to reassure, in a somewhat circular way, the reliability

of demographic reconstructions. Integration is becoming more than that, as I hope this paper and that presented here by Gruspier demonstrate. There is now a complementary approach to demography which considers anthropological evidence, cemetery archaeology, settlement archaeology, historical records and regional survey in conjunction.

This holistic approach is more appropriate to some regions and sites than others. Investigation must be highly detailed to maximise the evidence available from all sources, and so considerable resources are required. Excavation of complete sites should be possible. To obtain appropriate skeletal evidence the most suitable cemeteries should contain large numbers of well sequenced burials. Analysis must consider all aspects of archaeological evidence such as grave goods, depth of graves and so on. Labour intensive, multivariate techniques should be used to collect demographic data from human remains. Anthropological and archaeological evidence from cemeteries must be linked to intensive excavation of local settlements, historical accounts and regional survey.

As an illustration of the potential of this integrated research, I will use anthropological evidence from two sites where I have been involved in such interdisciplinary research.

Norton, northeast England – Anglian migration

The cemetery at Norton, near Stockton on Tees in northeast England, dates from the sixth and early seventh centuries AD (Sherlock and Welch, 1992). It was used by a community who had mainly adopted pagan, Anglian cultural attributes. No associated settlement or settlements have so far been discovered. The population showed a normal sex ratio, but very few children were buried in the cemetery. The people at Norton were not wealthy, although some were of higher status than others. Burial traditions were mixed, thirty-eight per cent extended (viewed as an Anglian tradition), twenty-seven per cent crouched (viewed as a native tradition), and six per cent prone. Burial position did not appear to be related to sex or status, although eighty per cent of weapon graves were extended (Sherlock and Welch, 1992).

This burial population can be used to test prevailing theories of Anglo-Saxon immigration, using both anthropological and archaeological evidence. The Anglians have been seen either as male migrants who integrated with native British females, or as overlords who had little integration with the British. These immigrants went on to develop Anglo-Saxon kingdoms of the middle sixth century AD. The majority of the group labelled themselves as Anglian by fashion, but retained a considerable British influence in burial tradition. Overall there appeared a mix of burial types for age and sex, although most high status males seemed to show some tendency to Anglian traditions (Sherlock and Welch, 1992).

Evidence of skeletal biology can be used to suggest certain genetic relationships both within a cemetery group, and between it and other populations (Rubini, 1996; Larsen, 1997: 302–332). Multivariate assessments of skeletal morphology for Norton indicated mixed affinities overall, but males were more uniform than females and showed more Anglian characteristics (which could concord with the more consistent burial position) (Marlow, 1992). Non-metric traits may be inherited and at Norton some demonstrated a high incidence. Septal apertures had a frequency of forty-eight per cent, compared to a ten per cent norm for other local groups. This trait also showed a sex bias, sixty per cent of affected individuals being female. If the trait is genetically determined such findings could appear to represent either founder effect, or an isolated breeding group, or the combination of the two. Spatial distributions of this trait in the cemetery indicated female-centred groupings. This is surprising as Anglo-Saxons have been suggested to be exogamous, patrilineal, and virilocal. A genetic basis for these groupings may reflect a combination of Anglian and earlier British traditions. The effects of a small inbreeding community could also be important here.

This anthropological evidence concurs with the archaeological, and suggests a mixed community of Anglian and British traditions. The Anglo-Saxon type appears dominant, with the males more uniform in Anglo-Saxon characteristics than the females. Non-metric traits indicate the possibility of founder effect and inbreeding. This would agree with the theory of a gradual Anglian immigration and integration. The possible grouping of related female graves may suggest alternative methods of social organisation.

Using ethnographic examples, Hodder (1980), cautions against the easy assumption that burial organisation need reflect lifetime organisation. The Nuba of northern Ethiopia are exogamous and virilocal, but inheritance is determined matrilineally. Females return to their birthplace for burial. Analysis of anthropological data from such a cemetery might instead suggest matrilocal residence. Ethnographic evidence can clearly change how we view burial patterns and the dead population is certainly not a direct reflection of a living community.

As well as using morphological markers to suggest genetic relationships for past populations, developments in the DNA analysis of human remains are also providing evidence of potential affinities (Francalacci *et al.*, 1996; Parr *et al.*, 1996; Vona *et al.*, 1996). DNA assessment of the Norton skeletons will hopefully supply further indications of the kinship and interactions of this group.

Kellis, Dakhleh Oasis, Egypt – the status of children

The Dakhleh Oasis is in the Egyptian Western Desert, 800 km south/south-east of Cairo. This region has only recently been the subject of intensive investigation because of its situation in a hostile environment so distant from the Nile. The Dakhleh Oasis Project is a long term, multidisciplinary investigation seeking to reconstruct and explain human adaptation to the changing environment in the area. It is a

very rich regional study involving researchers from many fields and many countries. Archaeologists are considering sites ranging chronologically from the Pleistocene to the Romano-Byzantine, using excavation and survey techniques. Anthropologists combine studies of modern growth and development with the analysis of skeletal and mummified remains. Careful planning is required, so that results are not lost in the large scale of the project.

The site of Isment el-Kharab has been identified as the historical town of Kellis, which dates from the first to the early fifth century AD. This regional administrative centre has revealed domestic buildings, temples and churches. Coptic and Manichean Christianity take over from pagan traditions as the dominant religions. Midden material has provided considerable economic evidence. Papyri and wooden documents detail both social and economic transactions, including farm accounts, personal letters, and wills. The occupants of the settlement utilized three adjacent cemeteries. Kellis provides an excellent opportunity for an holistic study relating burial communities to domestic information that is not often possible.

The burial grounds comprise above ground mausolea (unfortunately robbed out), rock cut tombs (Kellis I) and an inhumation cemetery (Kellis II). Kellis I is related to an early tradition of family burial, involving grave goods and often deliberate mummification. Kellis II is later, consisting of individual, unadorned burials, and is associated with early Christianity. Preservation of human material is excellent at both cemeteries. Excavations are ongoing.

Comparisons of the demographic profiles of Kellis I with those of Kellis II, and of related sites in the Oasis, showed Kellis II to be unusual in the proportion of child, and especially infant, burials present. Of the inhumations recovered so far 30 per cent were of infants, and of these 37 per cent were neonates. Particularly striking was the presence of two extremely young foetuses, one aged approximately twenty-eight weeks after conception and the other approximately eighteen weeks after conception. These age determinations used the techniques of Fazekas and Kósa (1978) and Scheur *et al.* (1980), which relate epiphyseal length to maturity. Attempts to sex the remains of infants are currently underway using DNA extraction (Götherström *et al*, 1997; Palmirotta *et al*, 1997; Stone *et al.*, 1996).

In 'dead' populations generally, fewer young individuals are found than might normally be expected. This can be the product of alternative burial practises and poor preservation. At Kellis II it seems that we may be able to achieve a more accurate picture of rates of infant mortality than is usually possible for cemetery populations. The high level of infant remains supports the archaeological and historical attribution of Kellis II as a Christian burial ground. An increase in child burials is also seen in other early Roman Christian communities (Watts, 1989). Child burial in the communal cemetery reflects the status of children, Christian attitudes to children and the sanctity of life. Sex determinations for the child remains will further studies of the status and treatment of children at Kellis. These should in time be augmented by documents from the site, as well as the wider historical record, for instance census records (Bagnall and Frier, 1994).

CONCLUSION

It is hoped that this paper shows that, in spite of methodological and evidential limitations, the anthropological analysis of human remains from cemetery sites can provide a valid source of demographic data. This evidence is most effectively utilized when integrated within a broader range of archaeological and historical sources.

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18. Problems and Prospects in Paleodemography

Claude Masset

Paleodemography from cemeteries is based on the age and sex determinations of skeletons. This kind of study, which was born in the late twenties, always gave strange results; notably, populations from cemeteries always seemed affected by a large over-mortality of females and by a near-absence of old people in both sexes. But as these results were always similar, anthropologists came to think that they indeed reflected actual demography, in spite of their surprising differences with ancient parish registers, of which some date from the beginning of the seventeenth century. It was as if a silent demographic revolution had come into play between the fifteenth century (date of the most recent cemeteries studied) and the seventeenth century, although no author from those times ever noticed anything of the kind. Yet it seems difficult to admit that such a striking change would have come about, as it were, absolutely unnoticed.

Reality was otherwise. Those too similar results came from the play of similar biases, from systematic errors originating from neglected statistical laws. It will suffice here to recall a few of them.

When an anthropologist tries to find out the age at death of an ancient skeleton, he or she compares this skeleton to a set of modern ones whose ages at death are known. This set is the "reference sample". It was formerly assumed that the age distribution of the reference sample did not matter, which is far from the case. To estimate an age at death, our anthropologist uses a process related to age, an "age indicator". Whatever the indicator chosen (closure of the sutures of the skull, pubic symphyseal face, cortical bone histology, etc.), its relationship to age is not a mathematical function, only a correlation. If we take for instance the case of suture closure ("synostosis"), if we know the age at death of one skull, its synostosis may be anything; nevertheless one can compute with confidence the average synostosis of several skulls, if their number is adequate. This value would be given by the regression of y (synostosis) upon x (age). But is the inverse regression legitimate, for age does not depend on synostosis? If we know the latter, how reliably can we compute the former (regression of x upon y) ?

On a scatter diagram, these two regressions are expressed by intersecting curves; on Figure 18.1, by the straight lines A and B, their angle being all the wider as the correlation is weak (the correlation is better for children, but the number of adults in a cemetery usually exceeds that of children). Figure 18.1 shows two samples, differing by their mean. One observes that, from the younger one to the older, whereas the first regression line (y upon x) remains more or less in the same place, the second one (x upon y) moves from the left to the right, shifting every estimated age by about 20 years.

Leaving the realm of mathematics, we could better grasp this phenomenon by imagining two extreme cases. First case: the reference sample comes from a war cemetery, in which most skulls are from young people. If, for instance, we take an interest only in skulls with no closure at all, we find plenty of them, with an age of perhaps 23 on average. Second case: the cemetery from which the reference sample comes has only old people, such as an almshouse. We should have difficulty to find skulls without any closure, but if the sample size is sufficient we are sure to find some. Their number would be small indeed, and their mean age at death well above 60. Let us say 73.

Now, if we try to find out the age at death of an ancient skull of unknown age with no synostosis, which is the best estimate: 23, or 73? Obviously neither one; then, which other? This example is of course rather exaggerated, being chosen for the sake of a demonstration, but it gives the gist of the thing. To estimate legitimately the age of a skull, it has to come from the reference sample itself. An unavoidable condition, and clearly a nuisance for paleodemographic studies.It has been shown that the reference population effect lessens as the correlation coefficient r grows between age and age indicator. But in the case of adults this coefficient never exceeds 0.70, when $r = 0.90$ would be necessary to distinguish reliably between 2 age classes, like for instance 20–39 and 40–ω; for 7 decennial

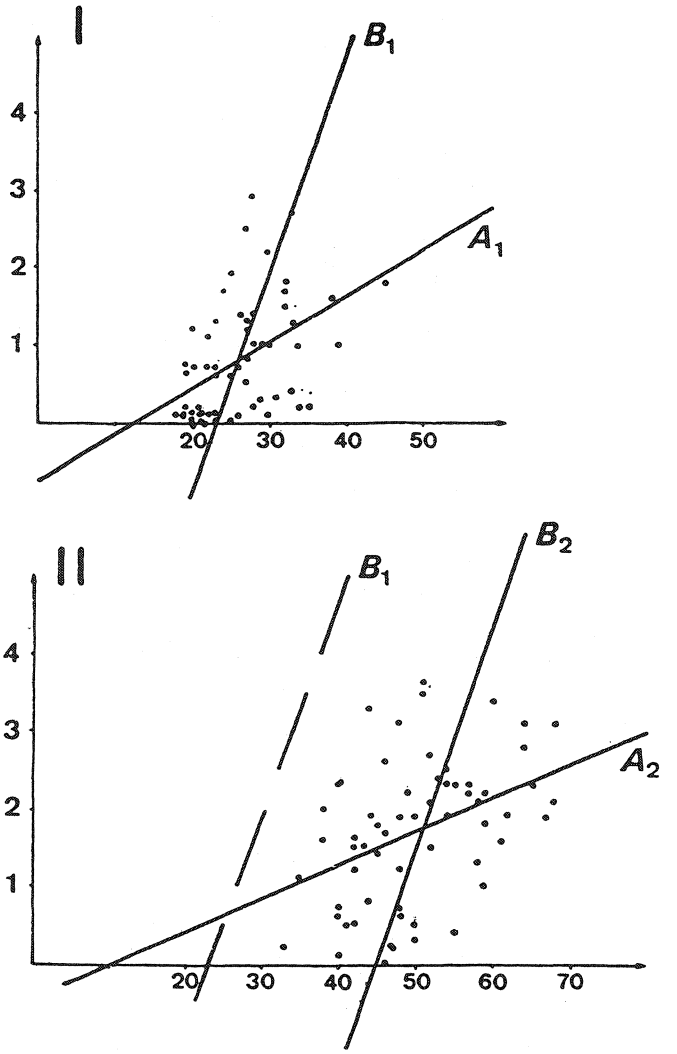

Figure 18.1. Influence of the age structure of a reference sample.

Graphs I and II depict two subsets of one cemetery population whose ages at death are known (the Lisbon sample of Dr. Ferraz de Macedo). The first subset has a mean age $\bar{x} = 25$ and a standard deviation $s = 5$, whereas in the second one $\bar{x} = 50$ and $s = 10$ (horizontal axis). The regression line A gives synostosis (vertical axis) as a function of age; when it remains more or less in the same place in I and II graphs, the regression line moves a good deal from left to right. Now B is the line which allows age "determination", since it gives the mean age corresponding to each degree of suture closure.

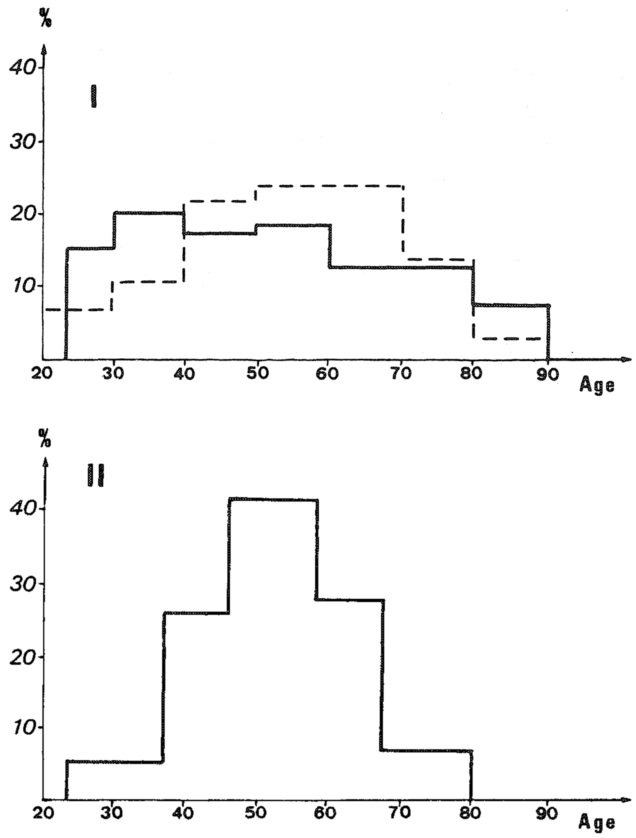

Figure 18.2. Distortions of age estimations in a sample of known ages from Coimbra (Portugal). Nemeskéri's method by pubic symphyseal face, the best age indicator according to Acsádi and Nemeskéri (1970). After Bocquet, 1977.

I. Continuous line: Coimbra sample; N = 460 – Broken line: Nemeskéri's reference sample from Budapest.

II. Estimated ages for the Coimbra sample. The histogram appears strongly affected by regression to the mean, which reduces younger and older classes to the benefit of middle ones. When taking this bias into account, one finds that the estimated distribution by ages appears intermediate between target (Coimbra) and reference (Budapest), and slightly nearer to the latter.

age classes, the requisite value would be $r = 0.984$, which is out of reach (Bocquet-Appel, 1978). Using several age indicators instead of one improves r, but not enough to legitimate more than one age class, except of course when the estimated sample comes from the reference sample itself (Lovejoy *et al.*, 1985; Bocquet-Appel, 1986).

Such a bias, for which there is no remedy, forbids any paleodemographic reconstruction of age classes at death. Other causes of systematic biases also come into play, the most important being the 'regression to the mean', which was shown by Galton as early as 1889 but almost always forgotten by paleodemographers working on cemeteries: by this bias young people seem older than they are, whereas old ones are considered younger, most of them significantly so (Figure 18.2). Remember that estimating the age at death of one skeleton always implies a range, within which the actual age is supposed to be; for instance, 45 ± 8. But distributing the ages at death of N skeletons is quite a different process; it results in a histogram, without any range at all: then where did the ranges go? Indeed the anthropologist has in mind an untold hypothesis, which is nothing else than a naive hope for an equilibrium between over- and underestimated ages. But this hope is demonstrably ill-founded; more precisely, it is attainable only for middle-aged persons. Clearly, to underestimate an old person's age is much easier than to overestimate it; so old ones' ages are on average always underestimated, and conversely young

ones' overestimated. The limit can be strictly impassable: for instance, in the collection of skulls gathered at Lisbon in 1882 by Dr. Ferraz de Macedo, the mean age at death of all completely synostosed skulls was 57. Consequently, in any cemetery sample compared with the Lisbon collection, nobody would ever be assigned more than 57.

There are other systematic biases, the most serious one concerning age indicators which, like the suture synostosis of the skull, differ from one sex to the other; as female skeletons occur less often than male ones in most reference samples, this kind of age estimator often leads to errors in female age at death.

There was in the early eighties a serious controversy about the legitimacy of paleodemography as it was practiced at the time (see Bocquet-Appel and Masset, 1982; Van Gerven and Armelagos, 1983; Bocquet-Appel and Masset, 1985; Buikstra and Konigsberg, 1985; Bocquet-Appel, 1986; Greene *et al.*, 1986). Mathematical considerations were rejected by scientists for non-mathematical reasons. But now things have changed: three years ago, a paper in the *American Journal of Physical Anthropology* (AJPA), following quite a different mathematical approach than the one presented above, came to the same results (Konigsberg and Frankenberg, 1992; see also Jackes, 1992). Henceforth we can greet with relief the coming back of old people into ancient cemeteries, the forsaking of female over-mortality, etc.

For the reasons above-mentioned, estimating the age at death of one ancient skeleton is risky, and distributing ages at death reckless. There is no chance for any mortality table computed from cemeteries to be true. It goes without saying that such dubious tables cannot support any conjecture relating to the vital statistics of the living.

Nevertheless information exists in skeletons about their sex and age at death. The problem is to ferret it out, without any pollution. There are fortunately some other ways to obtain information about the demography of ancient peoples. The first one begins by comparisons with recent populations whose vital statistics are more or less well known, such as Western Europeans from two or three centuries ago, Chinese aristocrats of the Ming epoch, Inuit from eastern Greenland, Bushmen from the Kalahari desert, Foulbe tribesmen from inland Senegal, etc. (respectively: Blayo, 1975; Cartier, 1973; Robert-Lamblin, 1986; Howell, 1979; Pison,1982). In spite of appreciable differences, these people show important common features: 1) a high infant mortality: of 1000 new-borns, 250 or more die before the end of their first year, and at least 250 others before adulthood. 2) Life expectancy is greater at twenty years than at birth, contrary to ours. This means that young adults have on an average still 35 to 40 years to go, some of them reaching occasionally much more. 3) At twenty, life expectancy is about the same for both sexes, notwithstanding female death at childbirth, because old women live longer than their male counterparts.

Such similarities between distant populations allow us to hypothesize that the demography of 'pre-jennerian' populations (anterior to Jenner's invention of vaccination) was governed by general laws more or less analogous. Formulas ('estimators') based on this hypothesis have been computed; they give demographic parameters, such as life expectancy at birth for instance, from data coming from cemeteries but escaping systematic biases. Jackes' 'Mean Childhood Mortality' is based on children's ages at death (Jackes, 1986), Bocquet-Appel & Masset's 'Juvenility Index' (1977), on the ratio between children and adults, to wit:

$$\frac{\text{(Number of dead between 5 and 15}}{\text{Number of dead after 20)}} \qquad \text{(briefly: } \frac{\text{D5–14)}}{\text{D20–}\omega}$$

The use of paleodemographic estimators implies having information on the growth rate of the cemetery population concerned, which is often impossible. But when we feel justified in hypothesizing a value for the growth rate (zero when our ancient population is supposed to have been 'stationary'), Mean Childhood Mortality or Juvenility Index can eventually give interesting results. An example of these is a cemetery of poor peasants from Carolingian times (VIIth–Xth century) located at Serris, a small village to the east of Paris, where the number of buried individuals was comparatively high: 953. A computation made from the Juvenility Index, on the hypothesis that the growth rate could not have been far from zero during 350 years, gave for the life expectancy at birth a value between 20.9 and 23.9 (to the nearest σ), an infant mortality (before 1 year) between 275‰ and 307‰, natality as well as mortality rates between 42 and 46‰, and a mean number of children for an adult woman between 5.7 and 6.4. The figures would have been somewhat less hopeless with a positive growth rate, even a weak one like 2‰: then life expectancy at birth would have been between 22.3 and 25.3; but growth rate is not easy to estimate. Tragic as their condition seems, it is not far from what the following method suggests for the same site (Guy, 1995).

That other method is based on age indicators of adult skeletons, with a reference sample having the same size in all its age classes; its most distinctive feature is to assign to each skeleton the set of probabilities it has to be in every age class, instead of estimating an age for it as in the traditional manner. This procedure, called 'probabilities vectors (or 'matrices') method', cannot indeed give a true image of the distribution by ages in a cemetery sample, only a distorted one; but it authorises reliable comparisons (Masset, 1982, 1989). In some propitious cases, a derivative of this method can even approach model life tables, as in an example from the early Neolithic in Bohemia, Czech Republic (Figure 18.3). Such results are not to be taken at face value: their use is to make comparisons possible between sites. An example of such

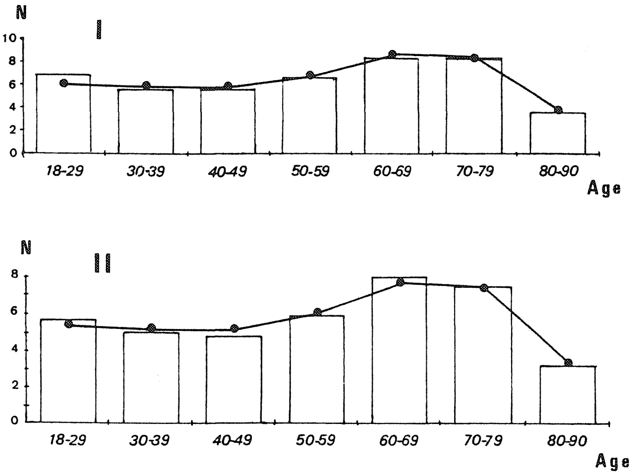

Figure 18.3. An image of the distribution of deaths by ages in two early neolithic cemeteries of Bohemia, Czech Republic, by a derivative of the probabilities vectors method, in which the distribution by ages of the reference sample follows a model life table, instead of all age classes being equal. After Crubézy et al., *1995.*

I: Vedrovice; N = *104 - II: Nitra Krskany;* N = *72. Both are early Linearbandkeramik (about 5700 BC).*

Histograms: by probabilities vectors method.

Jagged line: Ledermann's model life table (1969), "réseau 100, Q =30".

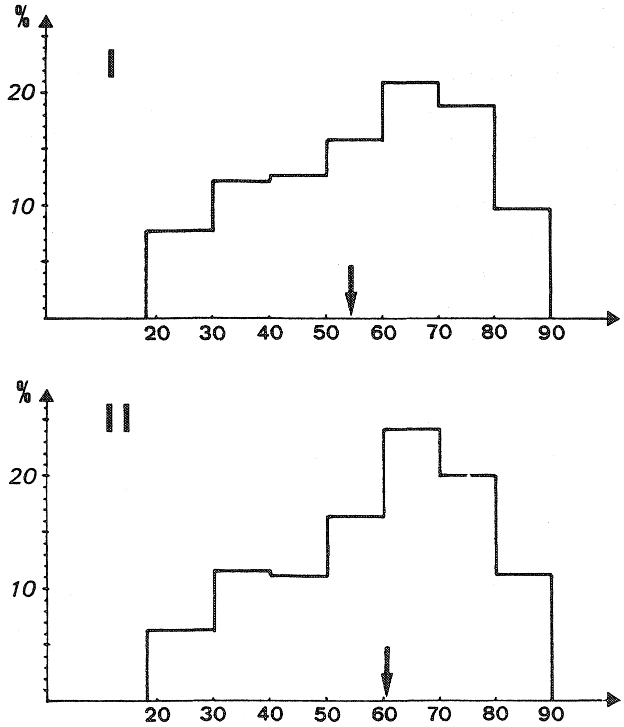

Figure 18.4. Social inequality with regard to death in Maubuisson abbey, late Middle Ages (Danion et al., *1994).*

Probabilities vectors method; remember that it does not give true distributions by ages, only distorted images which are nevertheless comparable with one another. Horizontal axis: age - vertical axis: percentage by age class.

*I: nuns buried under the cloister gallery (*N = *43).*

*II: nuns buried in the chapter-house (*N = *19). The arrows point out the centres of gravity which depend on the mean age at death; the latter appears higher for nobler nuns.*

is given by the royal abbey of Maubuisson, to the north of Paris, where texts from the XVII–XVIIIth centuries tell us that the noblest nuns were buried inside the chapter-house, commoner ones under the cloister gallery. An anthropological analysis of skeletons found at Maubuisson shows differences in mean ages at death between the former and the latter (Figure 18.4); as some skeletons are from the Middle Ages, it seems that the above-mentioned custom already existed in the first centuries of the abbey, which was founded in AD 1236: social inequality with regard to death is a well-known sociological feature (Danion *et al.*, 1994).

In more ancient times, near the shore of the Rhone river, the excavation of a vanished basilica from the VIth–Xth centuries also revealed an age at death higher for persons buried inside the building than for others (Figure 18.5); but there the difference seems too great to come from social hierarchy alone, it suggests some kind of selection: those buried people would have been selected after criteria linked with their age, social hierarchy perhaps among others. In fact, between the inside and outside of the basilica, skulls and stature are different; moreover the sex ratio is unbalanced, for there are 31 males and only 7 females inside the basilica (Bizot, 1988), against 10 males and 7 females outside it.

When the probabilities vectors method can shed light on a social hierarchy, it can also prevent errors in the interpretation of diseases, as was shown in a cemetery in

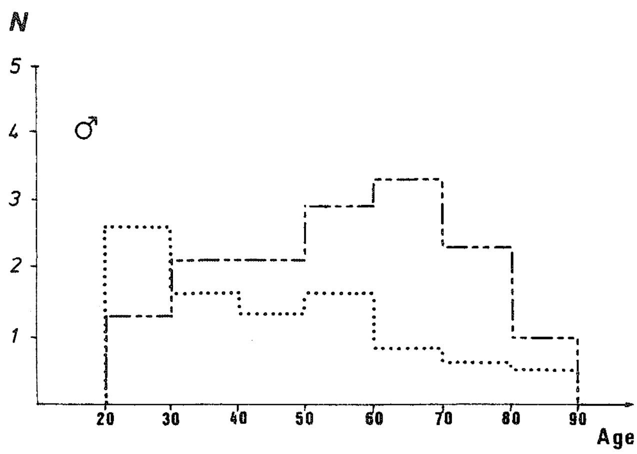

*Figure 18.5. Distributions by ages of male deaths at the ancient basilica of Albigny-Condion, early Middle Ages, VI–X*th *centuries (France, Haute-Savoie: Bizot, 1988).*

Broken line: inside the basilica, where the mean age at death was high. Dotted line: outside the basilica, where life was shorter.

Geneva: osteochondrosis, for instance, can reflect both age as well as pathological conditions (Kramar and Simon, 1988).

Comparisons between different periods inside the same cemetery are less secure, because the evolution with age of an age indicator was not necessarily identical through the centuries: in the case of cranial sutures a secular trend is even almost proven (Simon, 1987; Coquerelle and Guy, in press, Bocquet-Appel and Masset, 1995). Nevertheless it seems legitimate to hope that this was not the case from one century to the next: that, during so short a period, evolution would be scarcely perceptible. In this manner Simon discovered in a Swiss cemetery near Geneva a mortality crisis in the second half of the VIth century (Simon, 1983). Eight years later another anthropologist working in the North of France found the track of the same crisis (Blondiaux, 1988), with the additional information that it took place after 570–580 and was over in 620 (Figure 18.6). At the same time, Lower Normandy was not much better off (Pilet *et al.*, 1994). Is it interesting to observe that such a severe crisis was hitherto ill-known to historians. More precisely, if an outbreak of plague is well attested at the time, its demographic consequencies are not. Moreover, it is not at all certain that over-mortality principally came from plague. In fact, an author from that period, the bishop Gregory from Tours described diseases most of which do not seem to be plague. But, as comparisons were lacking, most people thought that Gregory's descriptions reflected Gregory's pessimism, his way of writing as it were, and were not necessarily significant from a demographic point of view. They were.

Our probabilities vectors method is perhaps bound to be some day replaced by a newer one by Jean-Pierre Bocquet-Appel and myself. This new method succeeds in giving without bias the mean age at death of a set of adult skeletons, whatever their real distribution by ages might be – a distribution it does not try to ferret out. It proceeds by iterative computing, given the probabilities of death by age for each adult examined, using 'iterative bayesian' (or, better: "iterated age-length key": Boquet-Appel & Bacro 1997) as well as 'iterative proportional fitting' procedures, two mathematical procedures giving the same results (Bocquet-Appel & Masset, 1996). This new method works satisfactorily even with weak age indicators, as shown by Figure 18.7. With 500 skeletons, the standard error for an estimated mean age is of the order of $\pm$ 2 years when r (correlation between age indicator and age) is between 0.5 and 0.6, values readily attained. Indeed it gives practically the same information as by probabilities vectors, but with only one number and no distortion. The lone result it ever gave is for a neolithic rock-cut collective tomb, an 'hypogeum' from Champagne. There the adults' mean age at death (by trabecular involution of the proximal epiphysis of the femur) was found to be 52 $\pm$ 3 (Bocquet-Appel & Masset, 1995; Bocquet-Appel & Bacro 1997). The corresponding figure in pre-modern France during the first well-known decade (1740–1749) was 54 (Blayo, 1975).

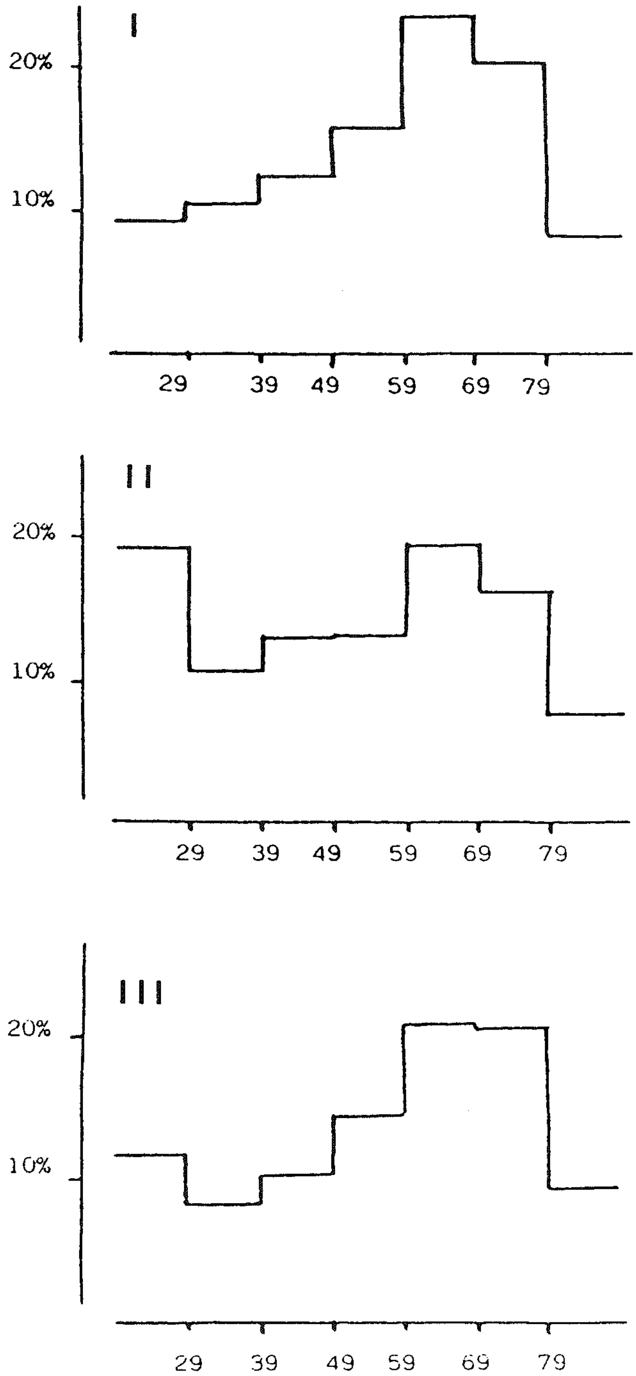

Figure 18.6. A mortality crisis in Merovingian times: Les Rues des Vignes at Cambrai, dépt. du Nord, France (Blondiaux, 1988). Probabilities vectors method: the histograms do not give true distributions by ages, only comparable images as in Figure 18.2. The number of dead was 239, but few could be securely assigned to a defined period of time.

I: early period of use (540–580; N = 25*) – II: intermediate period (580–620;* N = 21*) – III: late period (620–670;* N = 26*)). The age at death was higher during the happy years before 580 than around 600; the last period shows better conditions than the intermediate one, but not so good as the first one.*

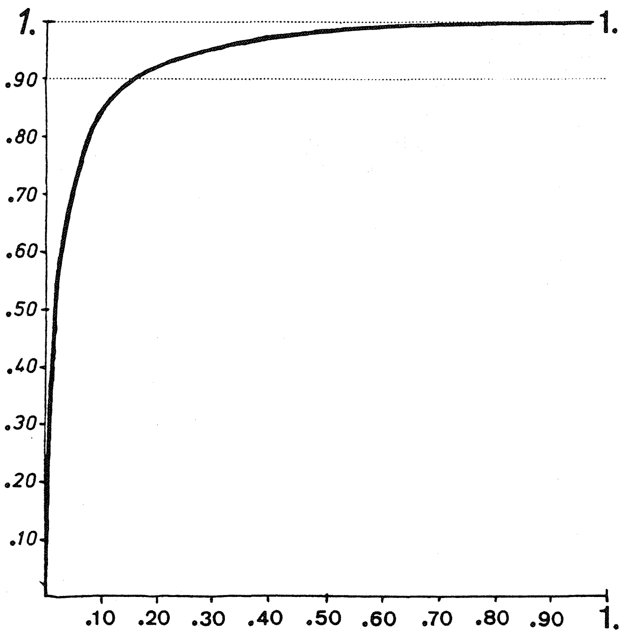

Figure 18.7. Average correlation between the true and estimated mean age of target samples obtained by 5 × 500 simulations.
Horizontal axis: correlation between age indicator and age. Vertical axis: average correlation between true mean age and estimated one. For standard error see text.

Under the hypotheses that the adult sample buried in the hypogeum reflected without selection the natural mortality of the corresponding neolithic population, and that its growth rate was negligible, its expectation of life at twenty would have been 32 years ± 3; probably more than at birth as was usually the case in pre-jennerian populations.

Formerly paleodemographers had an undue confidence in the anthropological analysis of skeletons. They had to climb down. Nevertheless the analysis of ancient cemeteries by sex and age at death proves useful: it gives glimpses into ancient mortality, it allows comparisons which occasionally inform about sanitary or hierarchical conditions; it can also reveal severe crises of mortality, some of them hitherto unknown to history. These results are, at the present time, precious few, but as more researchers work on ancient cemeteries, results are bound to multiply. For instance, what happened in Great Britain and in Italy during the late sixth century, when people died by the thousands in Switzerland and in France?

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19. Relating Cemetery Studies to Regional Survey: Rocca San Silvestro, A Case Study

Riccardo Francovich and Kathy Gruspier

ABSTRACT

Population Studies from the point of view of regional surveys are non-destructive, comprehensive, data gathering tools useful for interpreting demographic change in both prehistoric and historic populations. We have heard of the problems associated with demographic inference from a number of the participants. Our paper focusses on a very specific aspect of the reconstruction of demography from past populations; palaeodemography, and how the reconstruction of a population from a skeletal sample compares to other demographic indicators on one specific site from a finite time period. We present these data as a basis and perhaps guideline for reconstruction of population demography on the scale which is being discussed at this colloquium.

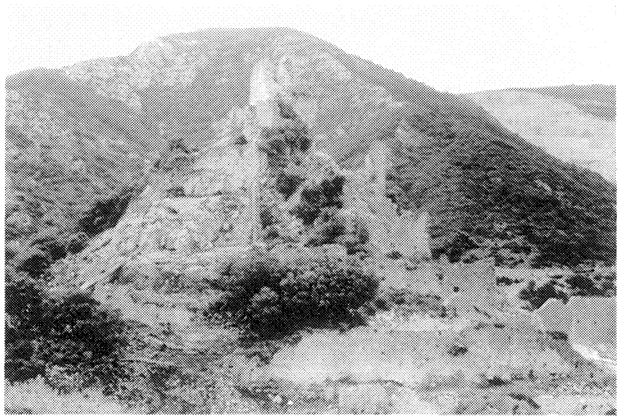

Figure 19.1. The castello of Rocca San Silvestro from the south (partially excavated in 1990).

INTRODUCTION

The site of Rocca San Silvestro is located in Tuscany, near the west coast of Italy. It is approximately 200 km north of Rome, and in the medieval period was controlled by families from Pisa. It was founded in the second half of the tenth century, for the explicit purpose of exploiting the mineral ores in the surrounding area (Francovich and Cecconi, 1991). The first historical account of the site dates from AD 1108, although it is referred to in documents dating from as early as AD 1004. The last reference that mentions the site dates from AD 1323, but archaeological evidence has suggested that it was occupied in part until the second half of the fourteenth century, and then intermittently until the early fifteenth century.

The fortified site appears to have been constructed according to a plan, which included the occupation area, the manorial area, the industrial area, and the church and cemetery. Rocca San Silvestro is one of approximately 3000 'castelli' in Tuscany, and it has been the object of systematic archaeological investigations since 1984 (Figure 19.1). Today, the site is the centre of an area which has been transformed into an archaeological-mineralogical park. The habitation of the castello, as noted above, lasted approximately three centuries. It was founded by the Gherardesca family of Pisa and passed on into the hands of the family of the Della Roccas at the beginning of the twelfth century. The economic base for the settlement was the extraction and working of mixed sulfides (silver galena and calcopyrite). The process of working these ores was controlled by the 'signorile', or the lords of the manor.

The demographic data which can be derived from the settlement itself suggest that there were approximately 50 houses in the habitation area during the period of maximum occupation. This implies that there would have been a population nucleus of between 200 and 250 individuals in the village at that time.

The participation of anthropologists was requested at the beginning of the site excavation, and again at the initiation of the excavation of the cemetery, in order to investigate the demographic parameters of the skeletal sample. Other anthropologists were employed to investigate the palaeopathological problems specific to a popu-

lation dedicated to the activities and occupations of mining and metallurgy.

The cemetery of Rocca San Silvestro is the first medieval cemetery which has been in its entirely. It was founded during the twelfth century, when it was constructed in front of the church dedicated to San Silvestro and dependent upon the parish church of San Giovanni of Campiglia, and is the only place of systematic burial in the habitation centre (Figure 19.2). No trace of burials made prior to the founding of the main cemetery have been found. A total of 7 burials have been recovered from areas outside of the cemetery. Four newborn skeletons were found, three within the houses, and one in the industrial area. With the exception of one, these newborns appear to have been discarded, rather than buried with any thought to placing them in burial attitude. These infants all come from contexts which are contemporary with the cemetery, and will be included in the final demographic analysis. Three adult skeletons have been found. The first was in the area of the iron works near the outer edge of the city walls, and postdates the use of the cemetery (Bartoli, 1987). The second adult was recovered from beneath the floor of the industrial area, and is dated to the third quarter of the thirteenth century. Although this individual is contemporary with the cemetery, it was most likely the manner of his death that precluded his burial with the general cemetery population. He was murdered by multiple sword wounds to the skull. Moreover, preliminary observations of cranial morphology suggest that he may not have been part of the indigenous population (Gruspier and Mullen, 1992). A final adult was recovered from between the city walls and a rocky spur of the castello. No dates have been assigned to this individual, nor has an analysis been performed, to date.

Figure 19.2. The church and cemetery of Rocca San Silvestro from the south, following the conclusion of the cemetery excavation (1995).

Along with the many questions which were posed as part of the archaeological research strategy of the site, the following arose from the excavation of the cemetery as perhaps being able to illuminate the social and religious aspects of the entire settlement:

1. Where were the burials of the entire settlement from its foundation until the end of the twelfth century?
2. Why was the tradition of inhumation outside of the settlement radically changed, so much so that a cemetery was constructed in front of the church in the very centre of the castello?
3. How and why did the transformation from burial outside to burial inside the settlement begin, and what was happening socially and religiously which immediately preceded this transformation?

THE HISTORICAL EVIDENCE

The tradition of burial near the parish church which housed the baptismal font (the 'pieve') was probably begun in the Carolingian period as part of its duty to collect tithes (Settia, 1991). This practice of having burials near the pievi was maintained during the course of the tenth century (Violante, 1977). Prior to the ninth century, as has been shown by archaeological research, different methodologies for the interment of the dead were in existence. Graves have been found near some 'pievi', while others have been excavated and no burials have been found. Private churches have also been found with associated burials.

It was only within the period between the second quarter of the twelfth century, and the beginning of the thirteenth century, that there was a strong affirmation of the process of territorialization connected with the development of the *signori* (feudal lords), which had formed sub-divisions within the parish church districts (Violante, 1977). This diffusion was assisted by new churches, and the acquisition of ever greater autonomy for the pre-existent chapels. These pre-existing chapels were progressively appropriated by some or other prerogative of the 'pieve', which then formed around itself an ecclesiastical territory where the inhabitants exercised the parochial functions.

These transformations during the twelfth century

brought about a proliferation of internal controversy in regard to the relation of the revenues derived from burial (Ronzani, 1980). In some cases during the course of the twelfth century, the right to collect tithes from the graves in the chapels continued to be recognized. The right of the 'pievi' to share in the offerings provided by the families which customarily used the burial places, was protected. In other cases, new limits were enforced on burials, whereby the 'poor', and the 'paupers' held their funerals outside of the traditional area of the 'pieve', thereby excluding those who did not pay offerings.

Basically, the 'pieve' of the twelfth century continued to perform baptismal functions and supplied the chrism and the holy oil for this rite. Other prerogatives of the 'pievi' were a source of continuous controversy, and the situation varied from place to place. The private penitence, the visits to the infirm and how the tithes from burial were collected, had been the prerogatives of the priest of the 'pieve', but during the twelfth century a fee for these services was paid to the chapel (Violante, 1977). The public penitence was the responsibility of first the bishops and then the 'pievi', while the first fire of the house was blessed by the rector of the chapel. The collection of tithes was undertaken by the chapels, and one-quarter was due to the 'pievi'.

The connection between the 'pieve' and its chapels was manifested in the procession of the 'litanies', which, composed of the clerics and the common people, moved from the 'pieve' and visited all of the churches in the territory. The 'pieve' had the responsibility of electing and installing the rectors for each church or chapel under its control, although in practice it was generally left up to the patrons of the specific church to select whom they wanted.

THE ARCHAEOLOGICAL EVIDENCE

The archaeological excavation of the cemetery has revealed burial practices which are fully concordant with those outlined in the writings referenced above, and in other sources consulted.

The construction of the cemetery was undertaken in two fundamental phases following the construction of the church. The initial construction of the church was between the eleventh and twelfth centuries, and there was a rebuilding of the church apse, concomitant with a short elongation of the church itself, sometime within the twelfth century. The entire interior of the church was excavated to bedrock, and no graves were found.

The dating of the church places the construction precisely at the passage of the *signori* from the Gherardesca family to the Della Rocca family, at a time when the control of power over the area was defined and consolidated. There was obviously a strong coincidence between the construction of the church and the affirmation of territorialization by the 'signorile'. It may be suggested that this transition to territorialization, amongst other things, motivated the construction of the church, the city walls and in particular the gate of the castle and its tower. This new construction on the site was undertaken in part by imported workers.

Following the building of the church, the construction of the first phase of the cemetery wall was undertaken by local craftsmen, utilizing a technique which had already been used elsewhere on the site (variant b of Type I). This technique has been classified and is attributable to a period of time between the first half of the twelfth and the first half of the thirteenth century, concomitant with an explosion of construction within the settlement. The knowledge of these building techniques had been imported by the foreign craftsmen (Bianchi, 1995).

The first phase of the cemetery retaining wall included the construction of three tombs, hypothesized to have been solely for the use of the privileged class. The same retaining wall contains a fourth tomb in its south-east corner, a mere 3 metres distant from the other three. The space between the tombs was filled with soil which was likely sealed by a layer of lime mortar.

The second phase of the use of the cemetery is defined by the filling in of the space between the isolated tomb and the tombs attached to the church. During this phase, it appears that the soil layer covered by mortar was mostly removed. Graves were cut into the bedrock, and skeletons and their grave markers were recovered lying directly upon the bedrock. The previous fill layer may have been used to cover the graves, as there was some indication of decomposed limestone in the fill. It should be noted that the graves in this phase were distinct from those of the later phase, in that they had stone markers and in some cases stone grave liners. One of the graves was distinct from the others by virtue of the very bright yellow lime mortar fill which covered it (Figure 19.3). Another grave was carefully cut into the bedrock, although only a small portion of the original occupant remained in the cut. These

Figure 19.3. Burials from early in phase 2. The adult on the right was covered in limestone. Both juveniles depicted have grave markers.

very early graves are difficult to interpret, and may represent a continuation of burial of the privileged class only (phase 1), or may indeed represent the rest of the community. The very small size of the cemetery itself would have precluded many more individuals being buried with so much space surrounding them, and more importantly, not being disturbed by later interments.

The third phase included an elevation of the retaining wall sometime after the second half of the thirteenth century. The burials became quite dense, with the burial mode being one of continuous disturbance of previous graves by fresher ones, with the remains of the earlier occupant being secondarily replaced on the remains of the subsequent individual, (Figure 19.4). This phase can be further subdivided into subphases A and B. In phase 3A, tombs 3 and 4 were covered by the general cemetery layer, with some of the outer wall of tomb three being removed at that time. As the number of burials increased and the cemetery filled up, the second tomb was also covered by skeletons, although its original construction remained intact. In Phase 3B, only the first tomb attached to the front of the church was visible, its height having been increased by three or four stone courses. Burials in this phase were placed on the pathway which had originally led from the cemetery entrance to the church entrance, and it is assumed that this access to the church was no longer used.

It would seem that the space of time which existed between the construction of the church, and the building of the tombs of the privileged class within the cemetery retaining wall, was brief. It did however, exist. It is likely that the builders/overseers of the church were the first to invoke the prerogative of burial outside of the 'pieve' and in the cemetery of Rocca San Silvestro. This usage was then transmitted to their subordinates and then to the remaining population of the village. During this brief period, the small number of interments in the cemetery supports the practice outlined in the historical literature, that the vast number of skeletons of the 'poor' may have been carried some distance away for burial.

To sum up, the beginning of the usage of the cemetery of Rocca San Silvestro may be placed within the space of one century, between the first half of the twelfth century and the first half of the thirteenth century, with the recognizable phases being:

1. The construction of the church (first years of the twelfth century).
2. Setting up of the first phase of the retaining wall with the tombs of the privileged class.
3. Expansion of the church.
4. A broadening of the right of burial to the community (which started in the centre of the cemetery).

It was only in the middle of the thirteenth century that the role of the privileged tombs was limited (of the original four, only one was still in use), with a concurrent enlargement of the area used for community burials. This enlargement followed a trend already seen in the village. The pressure on the 'signorile' was beginning to weaken them, starting in the second quarter of the thirteenth century. This pressure from various sources produced disruptions in the hierarchical system, making it appear that they were governing according to individual interests, rather than running a government organized into well-defined sections.

Figure 19.4. The cemetery in phase 3 showing secondary deposition of disarticulated remains over articulated skeletons.

Given the temporal interpretations derived from the building phases, and the known time of abandonment of the site due to a change in metal working technology, the very broadest span of time in which the cemetery could have been utilized, encompasses only two centuries, and likely less.

THE PHYSICAL ANTHROPOLOGICAL EVIDENCE

As the archaeological evidence derived from the careful excavation of the entire cemetery appears to support the historical documentation, so too does the evidence of the demographic profile of the population support the hypothesized period of use of the cemetery. It should be noted that the demographic parameters presented here are only preliminary, the excavation having been completed in 1995. Only the skeletal remains from the first two seasons of excavation have been thoroughly analyzed.

The cemetery is approximately 8 m by 5 m in area, the bulk of the burials having been excavated from an area 4 m by 2.5 m in size. The deepest part of the cemetery is only approximately 3 m from the cemetery surface. The total minimum number of individuals is 351, 30 to 35 of these deriving from the tombs. Figure 19.5 depicts the skeletal sample excavated from the cemetery by broad age category. The minimum number of individuals (MNI) may increase slightly with further analysis, as many of the inhumations were partial, and there was a large amount of

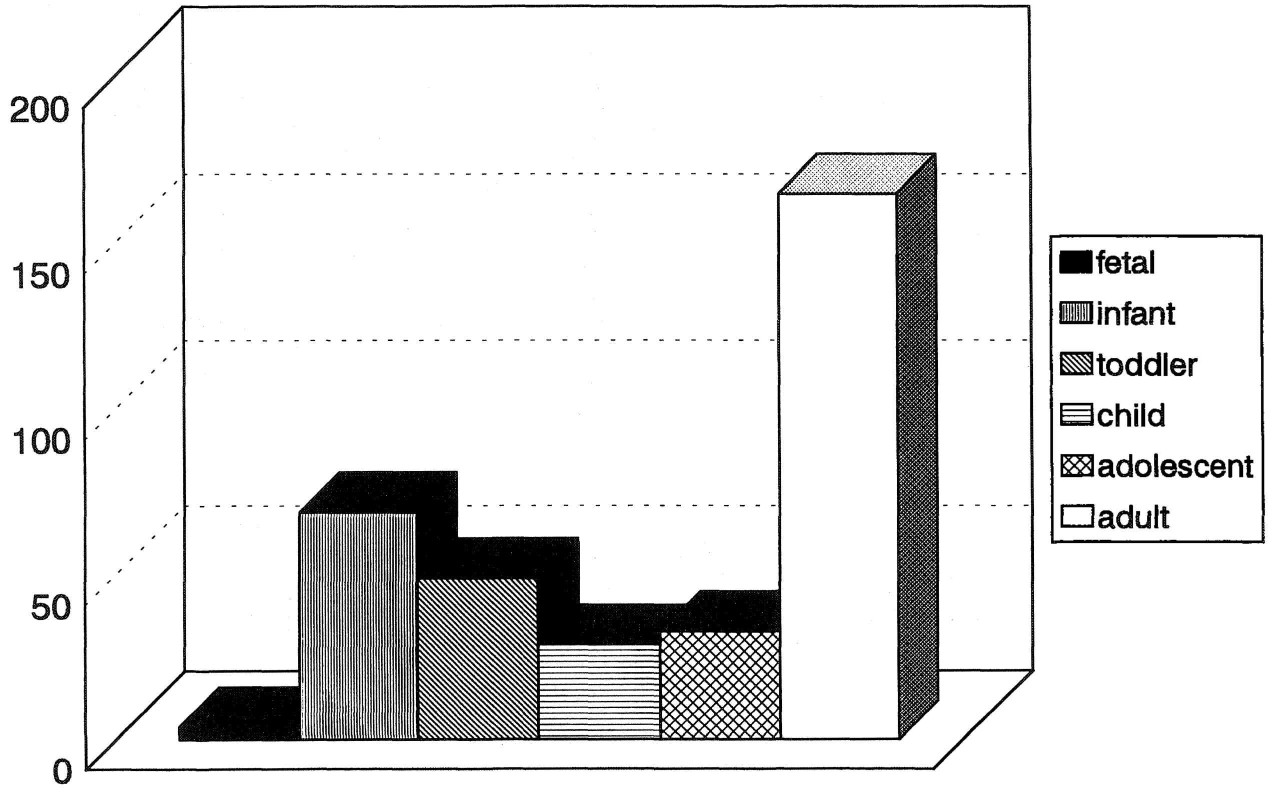

Figure 19.5. Total number of articulated skeletons excavated at Rocca San Silvestro, including all phases.

mixed bone in the cemetery. The excavation was undertaken very stringently. Each burial or part thereof, or a defined secondary deposit of disarticulated bone, was treated as a separate feature, and duly recorded as such. The remainder of this report will deal with the skeletal remains attributable to phases 2 and 3 only. As stated above, phase 1 was defined solely by the tombs of the privileged class. These were re-used for a period of time, and consequently, it is unknown whether the burials excavated from these tombs were the original interments. This is especially the case with the first tomb closest to the church, as excavation has revealed that it was definitely re-used in phase 3. This problem will be dealt with at a later time. More importantly for this presentation, the tombs of the first phase do not reflect the general population demography, and are therefore biased in their representation of skeletal remains.

Phase 2 and 3 cover an estimated time span of approximately 125 years. The three phases (2, 3A and 3B), may represent 40 to 45 years of interment each, or, a generation. There is some indication that phase 3A was in use for a longer period of time, although this is only due to the sheer number of individuals in this phase. Whether phase 3A is exhibiting an increase in population, or is indicative of a longer period of use, cannot be addressed at this time. Figure 19.6 shows the breakdown of deaths by broad age category over the three phases. Figure 19.7 shows the same information, but presents the percentage of deaths by broad age category in each phase. The MNI represented in these charts is 321 individuals. If we assume that each one of these phases is representative of a generation, then the mortality profiles should reflect the demographics of the population living at the site, and/or what was occuring socially at the site.

Figure 19.7, phase 3A approaches what would be assumed to be a "normal" mortality distribution for a stable population in a pre-modern industrial society. There is a high infant mortality, with a lower frequency of subadult deaths, while most deaths are contributed by the adult cohort. The adult cohort may appear to be proportionately large, but it includes all of the adult age groups which would normally be dispersed across a number of 5 year age categories. Phases 2 and 3B are clearly showing non-normal mortality distributions. With the benefit of the historical documents which have illuminated the social and political practices surrounding disposal of the dead during the time in which Rocca San Silvestro was occupied, we may provide alternative hypotheses to the observed rates of death, with some measure of confidence. Similarly, the interpretive information derived from a near total excavation of the entire site will allow for other assumptions to be extrapolated from the data. For instance, the infant mortality within phase 2 far exceeds that of other age categories, including the combined adult category. This could be interpreted as evidence of a population which was

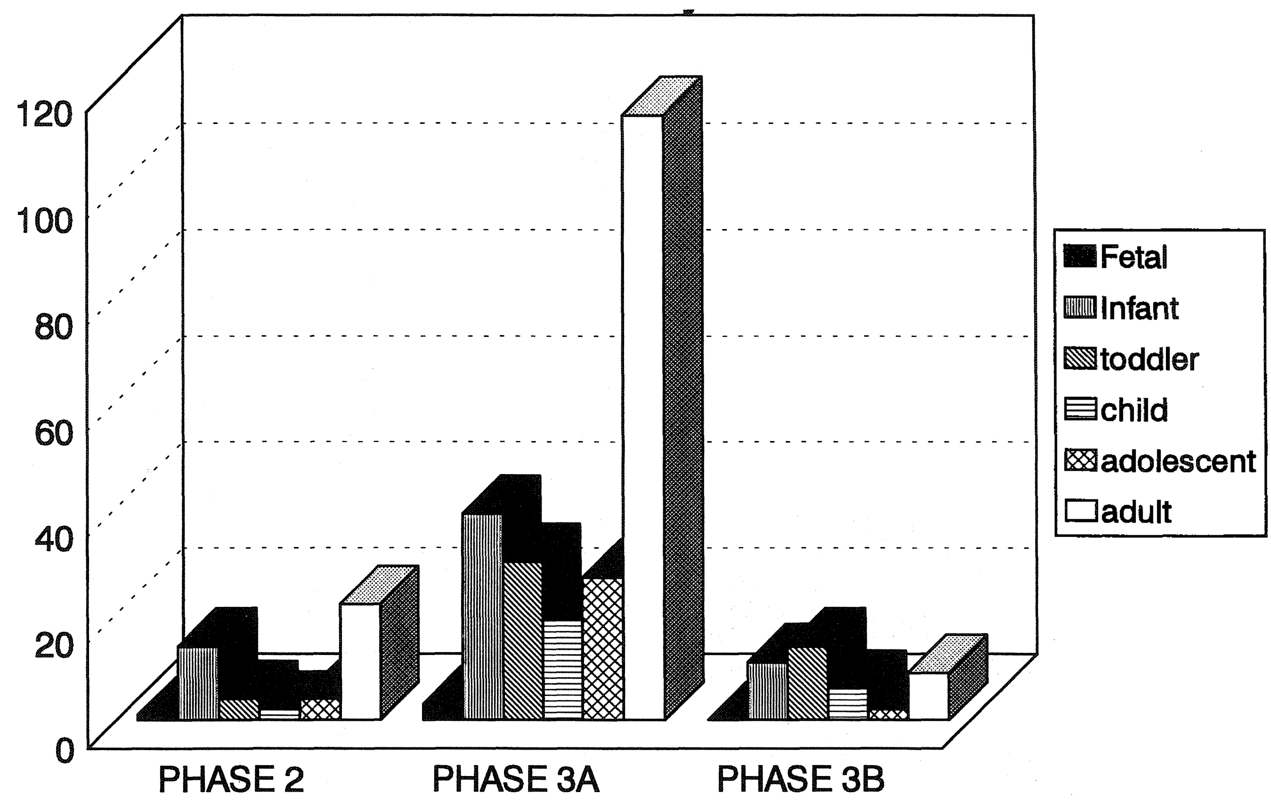

Figure 19.6. Number of dead in the cemetery at Rocca San Silvestro, divided by phase of use. Data are preliminary, and given by broad age categories only.

unhealthy and unstable, and one in which life expectancy at birth was severely challenged. It may also suggest that an epidemic of a disease particularly affecting infants, or systematic infanticide was occurring at the site during that phase. An alternative interpretation derived from the contemporary documentaion could be that the older children and the adults in this phase continued to be buried in the built tombs as they had in phase 1. Although the burials in the tombs cannot be definitely associated with phase 1, there are very few infants within the structures, the bulk of skeletal remains deriving from adults. As stated earlier, phase 2 is difficult to interpret. The infants in the greater cemetery area may represent the offspring of the privileged class which were buried in the built tombs before the use of the cemetery was extended to the community at large. In this scenario, the adults, older children and some of the infants may represent the earliest use of the cemetery by the greater community, without a noticeable change in burial practices. The abundance of infants may also represent surreptitious burials, although there is no documented suggestion of such a practice.

Phase 3B exhibits a disproportionately high frequency of toddler deaths and a very low percentage of adult deaths. The high toddler mortality may be interpreted as reflecting a relatively unhealthy population where weaning age deaths were common. This would suggest that childhood diseases and a lack of sufficient nutrition were a problem in the settlement. In fact, the information derived from historical sources strongly suggests that Rocca San Silvestro was in decline by this last phase. The signorile were becoming corrupt, there were raids on the settlement by other lords, and a general reorganization of territory through hostile takeover or loss of trade contacts was taking place just prior to the site abandonment. The increased rate of mortality of the most vulnerable section of the society (the weanlings) is not unexpected, given these circumstances. It need not suggest that the individuals living at Rocca San Silvestro had always been subject to a lack of adequate foodstuff, or that because of this they were more susceptible to mortal infectious diseases. In fact, faunal analysis and botanical flotation and landscape survey have demonstrated that the diet of the inhabitants for most of the duration of habitation at the site was abundant and varied. The lack of adult burials in this phase is simply due to the fact that the site was abandoned by them. The archaeological evidence clearly indicates that the site was deserted, not destroyed by any catastrophic means. The reason for this abandonment can be found in historical documentation which outlines the new methodology for metal working which involved an accessible and abundant supply of water. There was no running water supply within the castello. Water was caught in cisterns or brought up manually from the valley. Other documented social factors may have played a role in the abandonment

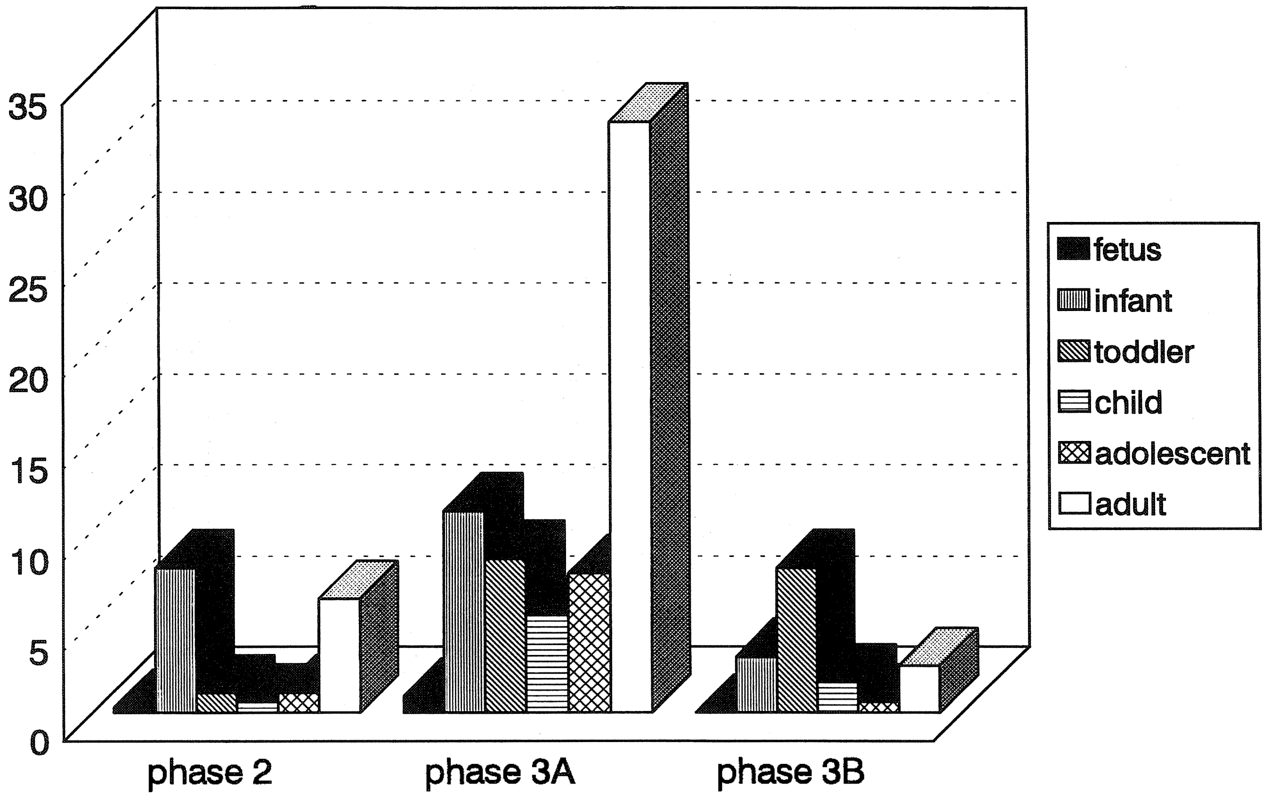

Figure 19.7. Rocca San Silvestro: Percentage of dead by phase of use, each phase representing roughly a generation. Note that phase 3A depicts an expected mortality distribution, while phases 2 and 3B do not.

of this and other Tuscan castelli (see Ginatempo and Giorgi, this volume).

Phase 3A can be assumed to represent a cross-section of the population at the time when the village was at its height of occupation. The number of deaths contributing to this phase are 234 in total. As stated above, there were approximately 50 houses in the habitation area of the castle at this time, representing between 200 and 250 individuals. The number of deaths reflects quite well the number of individuals theorized to be living on the site for a single generation during the height of its occupation, as derived from the number of houses excavated.

DISCUSSION: PALAEODEMOGRAPHY

Palaeodemography, or the reconstruction of past populations through skeletal samples of those populations has been fraught with controversy. Once thought to be the primary tool in reconstructing the demography of past populations, it is often no better than any other method utilized for interpreting demographic parameters. This is not to say that it cannot contribute to a database which could be used by archaeologists employing survey techniques to interpret palaeodemography and identify the dynamics of population change.

Criticisms levelled against palaeodemography arose largely from the methodologies used to determine age at death from human skeletal remains, and the use of statistics to transform these data (Petersen, 1975; Bocquet-Appel and Masset, 1982). Replies to these criticisms defended the skeletal ageing techniques in use (Van Gerven and Armelagos, 1983), and made recommendations as to how to improve ageing and statistical techniques, and suggested the evaluation of results against reasonably expected demographic patterns (Buikstra and Konigsberg, 1985). The use of model life tables had already been attempted, and was proving a useful way to interpret the fitness of past populations (Acsádi and Nemeskéri, 1970; Howell, 1982; Hassan, 1985; Weiss, 1973). A number of advances have been made in age at death determination techniques from skeletal remains in the past ten years (for a review see Jackes, 1992, and see Masset, this volume). Advances in research still need to be made however, as Roth (1992: 186) states:

> "....palaeodemography would benefit from adopting multivariate models to analyze mortality differentials, use ethnographic analogies to indirectly estimate age-specific fertility levels for skeletal populations and make more extensive use of computer simulation methodology".

These are methodological problems which are not insurmountable, and given a good skeletal sample to begin

with, could be addressed. Much of the problem in interpretation of demography from palaeodemographic data lies in the skeletal samples themselves. Jackes (1992: 214) lists four major biases in determining the average age at death (which is necessary for calculating 'the crude mortality rate' or 'the crude birth rate'), which disallow the use of these rates for comparative purposes:

1. In many archaeological samples, children and especially infants are under-represented.
2. Average age at death depends on the ability of the physical anthropologists to assign ages at death which are higher than 50 years (not usually possible using gross morphological means)
3. The calculation of average age at death relates to the overall accuracy of age estimations of skeletons over the age of 25 years (often this cannot be accomplished within a span of five years, as is necessary to construct a life table).
4. Not all adult skeletons in an archaeological population can be assigned an estimated age.

Infant under-representation at Rocca San Silvestro does not appear to be a problem. In the final analysis, those infants recovered from the houses can also be added to the database. It is questionable, at least in one case, whether the adults buried outside of the cemetery actually derive from the population, therefore biological distance analyses will be performed before these individuals are added to the database. In relation to point 2 above, the analysis phase of the skeletal material will include histological ageing of both teeth and cortical bone microstructure. This should add to the many morphological methods already being utilized, in order to assign ages to those individuals who were older than 50 years when they died. Point 4 could be a problem, especially in a cemetery like that of Rocca San Silvestro, where the small area and large number of burials forced the inhabitants to continually disturb earlier graves. This practice left very partial skeletons in many cases. The stringent excavation techniques employed at the site may alleviate the problem somewhat. All secondary interments were treated as separate features and all loose bone was located by its relation to the features around it. Loose bones may therefore be located stratigraphically, and will be analyzed along with the incomplete skeletons excavated both horizontally and vertically in relation to them. While it is recognized that not all skeletal elements will be possible to match up, it is hoped that many of the incomplete skeletons will be 'fleshed out', providing more age information. Finally, point 3 has always been a contentious issue in palaeodemography. It is often possible to give an age span of ± 10 years with a complete skeleton, but life tables require a ± 5 year age span in order to calculate the average age at death for comparison to other populations. Perhaps general age categories (e.g., infant, toddler, young adult, old adult), similar to those presented in this chapter are sufficient for comparative purposes when dealing with archaeological populations. After all, the fitness of populations is usually judged by such things as weaning age deaths, deaths of fertile females and infant deaths. Broad age categories can address these questions concerning health and longevity of past populations.

A recent paper on the subject, albeit dealing specifically with the inference of health from skeletal samples, calls for a 'tight control over cultural context', as well as other things, in order to 'make sense of the biomedical consequences of the major social and environmental changes that have occurred during the course of cultural evolution' (Wood *et. al.*, 1992: 358). This symposium is attempting to do a similar thing by addressing many issues dealing with the inference of population change in Europe. The case study which is presented above provides just that, control over the cultural context, and interprets the demography both as it contributed to cultural change, and resulted from social change, at a specific village, within a short time period.

CONCLUSION

The importance of the preliminary results from the cemetery of Rocca San Silvestro as they could be applied to this symposium are:

1. The palaeodemography derived from the skeletal sample agrees with that which has been calculated from the excavation of the houses on the site.
2. The site has been almost totally excavated, and the area surrounding it has been surveyed. Historical documents add to the information gleaned from the survey in regard to the amount of land which was used by the village to grow certain foodstuffs, and to pasture animals (Lemut, 1985).
3. The nearly complete excavation of the site has resulted in the retrieval of almost all of the material culture from the site (i.e., potsherds, coins, weapons etc.). This can be enumerated and the numbers used by others engaged solely in survey, to extrapolate demographic information from other, similar sites.
4. This presentation has outlined the importance of careful, stringent excavation of cemetery sites, especially those as stratigraphically complex as Rocca San Silvestro. Without thoroughly recorded excavation, undertaken by or in the presence of a physical anthropologist, much important information will be lost. The loose, mixed bones are every bit as important as the complete skeletons if a full demographic assessment is to be obtained, and the sample is to remain unbiased. It follows that the analysis of the sample must also be undertaken by experienced physical anthropologists so that the results can be interpreted and utilized for comparative purposes, with confidence.

Although other hypotheses may be advanced to explain the demographic profiles presented here, taking everything into account, an explanation based on the social-cultural

factors operating at the site during this time period is the most parsimonious. These preliminary results can address all of the demographic issues under consideration at this symposium, with the exception of fertility. When the skeletal sample is fully analyzed, and life tables are constructed, more specific issues concerning mortality, fertility and disease will be addressed.

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20. Counting Heads: An Overview

Jeremy Paterson

At the very moment in the late third century BC, when Rome was starting to loom like 'a cloud in the west' over the affairs of Greece, Philip V, the Hellenistic king of Macedon, showed in a letter to the city of Larisa that he well understood the mainspring of the Roman power which was soon to transform his world:

> 'I believe that no one would disagree that it is the greatest benefit for the city to grow strong, with as many as possible having a share in the state, and for the land not to be worked inadequately, as it is now. It is also possible to look at others who make similar enrolments of citizens. Among them are the Romans, who receive into their state even slaves, when they have freed them, and give them a share of the magistracies. In this way not only have they increased their homeland, but they have also sent out colonies'. (*SIG* ^{3} 543)

Rome's ability to mobilize vast numbers of adult males was fundamental to its success as an imperial power. So questions about the size, composition, and growth rate of the population of the Roman world ought to be far more central to historians of Roman imperialism than they have been. Similar claims can be made for other great historical movements at other times. Let there be no doubt. Demography is one of the keys to historical understanding.

But it is one thing to ask the great questions; there is no assurance that the study of the historical record can provide answers. Scepticism, even despair, may be the appropriate response, at least for some periods and some approaches. Consider a minor example from my own field of study. There is a clear literary tradition that the Greek cities of southern Italy suffered decline and depopulation in the last two centuries BC and first century AD. Yet archaeology is demonstrating that this is just not true for many of the communities. The literary tradition is Roman and should be seen as part of a moralizing thesis of decline developed by the Romans with scant regard for the realities, in order to justify their takeover of the area (Lomas, 1996, and see also Alcock, 1993).

The epigraphic record from the classical world seems to hold much greater potential. Yet Keith Hopkins long ago demonstrated the inescapable defects of this body of evidence (Hopkins, 1966–67). In the same manner, Tim Parkin has extended this critical approach to the whole range of evidence available to the historian of the classical world in his important study (Parkin, 1992). In this colloquium he remains essentially pessimistic about the possibilities of progress. His only suggestion of a way forward is the exploitation of model life-tables. But here we encounter the fundamental problem of using comparative data. How do we know that the data from other periods is strictly comparable to the material we are primarily studying? Which model life-table is the appropriate one?

Since the publication of Parkin's book, there has appeared a careful and cautious analysis of the best body of population data from the ancient world, indeed from any period down to the Renaissance (Bagnall and Frier, 1994). This consists of some 300 census returns for households in Roman Egypt. It may be that Parkin's hypercritical approach is unreasonably negative. Despite his doubts, this analysis produces positive results and suggests a picture of Egypt's population, which is largely unsurprising and (apart from the prominence of endogamous marriage) much what might be predicted for a high-mortality, preindustrial 'Mediterranean type' of society. At the very least, the census returns reveal how some households are structured in detail, thus enabling the proper use of comparative data to work out what the demographic consequences of such household patterns were likely to have been. Of some significance for field surveys is the demonstration that there were notable differences between the households of the towns and those of the villages. In the countryside there were many more complex households (extended or multiple families) than in the towns, and the possibility that women married earlier in larger numbers in the villages than in the

metropoleis. It may be possible also to posit a significant surplus of males, unable to find a wife in the villages, who migrate to the towns, only to exacerbate the sex ratio in urban areas. Of course, the evidence has its limitations. The census returns do not help at all in revealing either the pattern of change in the population of Egypt over time nor the total size of the population at any period.

Masset also belongs to the critical wing in another hopeful area, that of palaeodemography. He has demonstrated what he considers to be insurmountable problems with the traditional anthropological analysis of skeletons and the inferences about age at death which can be drawn from such material (see also Bocquet-Appel and Masset, 1982). He offers techniques which sidestep, rather than overcome, the problems. These are based on the probability that certain general factors apply to all populations before Jenner's discovery of vaccination. Some of these are examined by Smith at this colloquium. Palaeodemographers have responded to Masset by incorporating his criticisms within new approaches. Francovich and Gruspier have suggested that positive demographic information can be obtained from sites such as Rocca San Silvestro. But the conditions here are rare enough: total excavation of the site, both of occupation areas and cemeteries, and a survey of the surrounding area. The important point here is that the historical development of the fortified site provides important clues to the interpretation of skeletal remains, which on their own exhibit in some periods rather strange distributions.

As Sbonias so ably pointed out in his paper, the task of the historical demographer is to develop techniques for the interpretation of sets of data, of which both the quality and content is weak, at least for most historical periods, and whose link with the structure of a past population is at best indirect. Yet, one of the most interesting outcomes of the colloquium has been how much that is positive can still be said.

Lo Cascio's analysis of the Roman census figures neatly illustrates just how much is at stake in issues of demography. The collection of census figures for Romans, scattered through our historical sources, should be a valuable indicator of demographic change in the Republic and early Empire. There are, of course, all the usual strictures about the accuracy of the census process and an added problem of the reliability of the transmission of the figures in the texts. It has long been recognized that the key to any understanding of these figures, is an explanation of the huge discrepancy between the scale of the last Republican census figures and the totals attested for the censuses under Augustus and the early emperors. It is fair to say that Beloch's interpretation, authoritatively reworked by Brunt, has held the field (Beloch, 1886 and Brunt, 1971). It involves an assumption that the basis of the figures changed with the Augustan censuses. This produces a low figure for the total population of Augustan Italy of just over 3 million. Now, it is worth pointing out just why Beloch and Brunt wish to minimize the size of the total population of Roman Italy. Our ancient literary sources are full of vague statements, lamenting the plight of the Roman yeoman farmer, a decline in the birth-rate, a massive influx of slaves, and difficulties in recruitment to the army. A total for the population which presupposes a decline would seem to help to explain all this. But, in reality, none of this material is objective observation. It belongs to the powerful rhetorical tradition of pessimism which dominated Roman writing of history (a prevalent assumption that things were best in a golden past, from which the present was in inescapable decline). This rhetoric, in turn, reflected the sense of crisis and dislocation among an elite which was having to come to terms with the uncomfortable consequences of winning a huge empire. If the Augustan census figures are taken at face value, then we are faced with a population of 10 – 12 million. Lo Cascio offers powerful reasons for suggesting that this is plausible. It makes it possible to give a much more credible figure for the proportion of slaves in the population. It can take on board the notable increase in urbanisation throughout the peninsula in the last century BC, while still maintaining the assumption that the majority of the population reside in the countryside. But we can go further. The high total presupposes significant growth in the population over the last two centuries BC. Population growth combined with the practice of partible inheritance suggests that every generation or two there would be a pool of people seeking new land, because their share of the family farm was no longer adequate. This is precisely the picture offered by our sources. The regular demand for land figures prominently throughout the Republican period. There is no need to presuppose a special crisis (dispossession by wealthy landowners or the growth of 'capitalist' agriculture) to explain the demand for agrarian reform. The peasantry of Roman Italy was always in crisis. Finally, population growth is much more likely given Rome's acquisition of an empire. For all comparable evidence suggests not just that population increase can fuel the desire to find new land, but also that imperial expansion in itself fuels a positive population response. Lo Cascio is right to emphasize that what is at stake in the interpretation of the Roman census figures is not some esoteric side-issue for historians, but the whole of our understanding of the processes of economic and social change in Roman Italy.

Three broad factors may be posited as major potential influences on the pattern of occupation of the countryside (Paterson, 1991). The first is what may be termed the 'natural economy'. In this the influence of climate, geography and geology predominate. It suggests that, other things being equal, the responses of people to these factors will be similar over long periods of time. The same sites will be occupied and reoccupied at different periods.

The second factor is the 'political economy'. Here issues of ownership, relationship with the city, state-inspired colonisation, taxation and security may distort the natural

pattern of occupation. As Ginatempo and Giorgi demonstrate, the occupation of the landscape may become essentially an expression of power-relationships. Further, their analysis also stresses the importance of including the central place – the castle, the village, or the city – in any assessment of population change in the countryside. Two general models are possible. In one the city and countryside pulse in alternating rhythms. Contraction in the city is accompanied by increased occupation of the countryside with the population dispersed across it. In the other, city and country rise and fall in concert. As the city population grows, so the countryside also fills up. Contraction of the city leads to depopulation of the countryside. This seems to have been the sort of pattern discovered in Classical Boeotia (Bintliff and Snodgrass, 1985).

Finally there is the influence of the 'market economy'. Kiel's detailed study of the Ottoman imperial registers reveals a population extremely sensitive to market forces, ready to adapt both to the availability of land and to the markets for different agricultural products. He also demonstrates that single crises, disrupting the local economy and population, have long-term population consequences.

Population change is rarely the result of the action of one simple factor. What we have to assess is the relative influence of a whole range of such factors. This must vindicate the underlying approach of this colloquium, which seeks to bring together a whole range of expertise and tries to integrate them, as Marlow suggests in her contribution. It is vital that the different disciplines be allowed to apply their own distinctive techniques to their data to reach their own conclusions (as Ginatempo and Giorgi point out, the grass always seems greener in a different discipline). We then need to apply the principles of convergence and contrast. Where different approaches come to consistent conclusions, then the convergence of their conclusions must increase the probability of the suggested reconstruction, even though the data exploited in each area may be relatively weak. In the cases in which the conclusions reached differ markedly, then this must feed back into a reanalysis of the data and techniques used in the light of the initial failure. Perhaps the most exciting possibilities are when one discipline suggests a fruitful strategy in another. So Kiel's study of the detailed census returns from communities in Central Greece should be a powerful means of checking the interpretation of data derived from detailed field surveys of the same area.

Detailed regional studies, which exploit a whole range of relevant disciplines, are proving more suggestive than the search to put figures to whole historical populations. Further, individual studies reveal on the one hand the complexity of dynamic change over time in different regions, but also that certain basic assumptions seem to apply to all historical populations in the pre-modern period.

So, caution certainly; but no pessimism. This is good news, because if we cannot reconstruct with some definiteness the nature, size and dynamics of historical populations, then the whole edifice of history is undermined.

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